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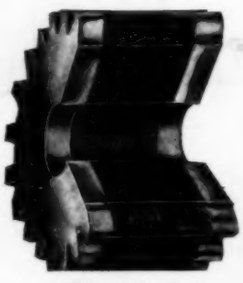

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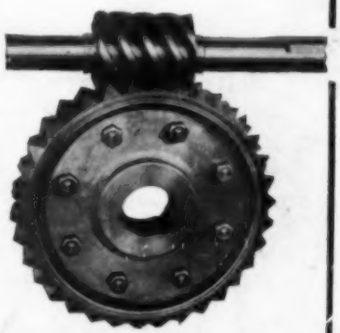

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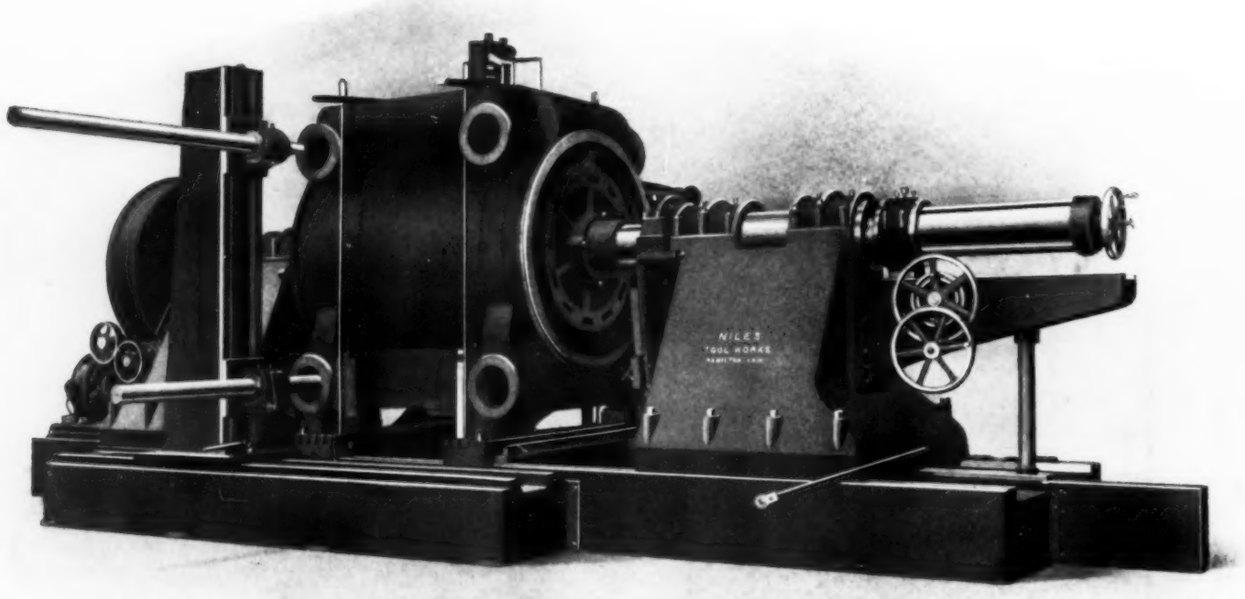

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(*See pages* 43, 44, 45 *and* 46)

Melting Cast Iron Chips in the Cupola

By W. F. Prince *

Full details of a successful process which has been in regular use for two years at the foundry of the Worthington Hydraulic Works. The results of physical and chemical tests are given and show increased strength and closeness of grain with no increase of hardness and no increased loss of metal. The cost is $1.40 per ton of chips melted.

*Superintendent, foundry department, the Worthington Hydraulic Works.

Ever since the machine shop began making chips, the foundry has been trying to melt them, not only for the purpose of saving the iron, but to help the machine shop to get them out of the way. In the past the greater part of the chips has been sold to the puddling furnaces, their worth being governed by the distance from such furnaces, and, in a great many districts, it has been found cheaper to throw them away or to use them for sidewalks than to hold and sell them. When sold to the furnaces they must be stored, be kept clean and not allowed to rust any more than possible, causing inconvenience to the machine shop and taking up valuable storage room. Moreover, the cost of handling is great, and for all these reasons but little success has resulted.

The Nail-keg Plan

Chips have been put into nail kegs and boxes and thrown into the cupola, but it can readily be seen that long before the chips get even red hot, the kegs are consumed and go up in smoke while the chips rattle out and go down through the charge, are burned up or blown out of the cupola, or, should they become trapped so that they do melt, they absorb so much sulphur that they are detrimental to the mixture.

It is a well known fact that increase of surface increases the absorption of sulphur. If one will imagine the amount of surface exposed to the sulphur gases if a piece of pig iron be cut into chips, he will understand while chips pick up more sulphur than pig or scrap iron. Iron boxes have been used, cast for the purpose, but they meet the same fate as the wood boxes for the reason that, as soon as there is heat enough in contact with a cast-iron box to melt it, it melts. We have, perhaps, imagined that heat enough was transmitted through the walls of these boxes to fuse the chips inside, but when we stop to reason it out we find it is not so. Imagine a box of chips thrown into the cupola with heat enough in contact with the box to melt it. The instant that the heat becomes sufficient to melt the last film of casing it melts. Meanwhile the chips certainly will not melt before the last film of the box melts, and the instant that film gives way, the chips are exposed to the fire and sulphur gases.

The Briquetting Plan

The chips have been put in briquet form, but here we encounter the same exposure to the flames and sulphur. If bonded together with a bond, such as pitch, tar, rosin, linseed oil, flour or starch, the briquets give way to the heat long before the melting point is reached, and the chips come into direct contact with the flames and gases, the great extent of surface which is exposed promoting the absorption of sulphur. The briquets also meet another fate as they go down through the charges of iron and become red hot and expand. The constant grinding and shifting of scrap and pig iron on top of them crushes and crumbles them, creates a loss and opens

The Prince Process of Melting Chips in the Cupola

up more surface for the flames and sulphur.

Chips Beneficial to the Mixture

These are some of the difficulties that have been encountered in the past in trying to use chips and borings. Those that have given the problem serious thought realize their worth in the mixture to a certain per cent., as they impart strength, close up the grain, and are beneficial in many cases. In going through the machine shop a great deal of the graphitic carbon is set loose and rattles out, making them a low-carbon iron. Also, so much graphite being exposed to the heat, a large per cent. of what is left is burned out, still further reducing the carbon, while the silicon and phosphorus are retained and the sulphur is not increased. After melting and cooling some of the remaining carbon separates out from the combined to the graphitic state if increase of sulphur can be prevented.

The Prince Process

The object of this article is to describe a new process of my own which has been in constant use at the Worthington Hydraulic Works, Harrison, N. J., for the past two years, with entire success. It overcomes the above named difficulties, disposes of the chips each day, as made, and improves the iron in the castings as to strength and cleanness, while giving no material increase of hardness. The process disposes of all chips made, which amount to about 7 to 8 per cent. in weight of the castings, and is patented, the principal claims being for the melting of chips or their like in a tube or casing of wrought iron or steel, or in a retainer of a more refractory nature than the chips that are to be melted. The chips are charged in tubes of about 12 inches diameter made in sections 3 feet long, of about 22- to 24-gage iron or steel, rolled up and crimped exactly like stove pipe. The bottom section is placed on a round iron plate about 16 inches in diameter and one inch thick, which is placed on top of the bed of coke and close up against the slide of the cupola. About three or four sections are placed on top of one another much like the jointing of a large stove pipe, the whole running from the bed of coke up to the charging door. These tubes are filled with chips, one or two charges of iron and coke being packed around them before the fire in the cupola is lit, after which the charging goes on the same as in the ordinary way. The location against the lining of the cupola protects the tube and keeps it up straight, and very little damage can be done to it, as it is filled with fine borings and chips. In effect it becomes a solid column down the side of the cupola.

How the Process Works

As soon as the melting starts and the coke and charges get down to the proper melting zone, the melting takes place. The tube or casing, being made of hard-rolled steel or iron, requires about 700 or 800 degrees more heat to melt than is required to melt the chips, and the chips pass into a pasty state and melt like the rest of the charge before the tube gives way. As the heat goes on, the casing does not give the flames or sulphur gases a chance to get at the chips as if they were open or in the loose form, nor can the gases get up through the mass of chips to a harmful extent. As fast as the charge melts and settles down, a new 3-foot section is added to the pipe and that section is filled with chips, and as this section settles down another section is added, and so on through the whole heat.

At first some difficulty was encountered in adding these sections after starting to melt, as the flames and gases were too hot for men to work, but a small amount of water, one-half a pail full, thrown on top of the charge at the charging door kills all this for a short period of time, long enough to add another tube.

Bar No.	Tensile Strength, Pounds.	Hardness Revolutions.
1	29,900	360
2	27,400	285
3	26,000	375

TABLE 1. RESULTS OF TESTS FROM A MELT OF 35 PER CENT. PIG, 45 PER CENT. SCRAP AND 20 PER CENT CHIPS.

Bar No.	Tensile Strength, Pounds.	Hardness Revolutions.
1	29,900	355
2	33,900	345
3	29,200	365

TABLE 2. RESULTS OF TESTS FROM A MELT OF 42½ PER CENT. PIG, 47 PER CENT. SCRAP AND 10½ PER CENT. CHIPS.

The Results

The results that have been obtained with this process up to a mixture of 10 per cent. of chips have been remarkable. Special heats have been taken for the purpose of obtaining all results. The loss has never reached a point over 4½ per cent. when using both pig and chips and, in a special heat of eight tons of chips alone, melted for the sole purpose of obtaining the exact amount of loss, it was found to be 5 6/10 per cent. A trial heat has been made of ten tons and after five tons had been melted the cupola was stopped and allowed to freeze up and cool off. When cold enough, each piece of coke and iron was picked out of the cupola from the top of the charge down to the melting point, to determine the condition of the tube at this point. It was found bent and twisted, but intact, the bottom resembling a tallow candle turned upside down, the chips being in a pudding mass from three inches to one-half inch thick up the tube from the melting point. The casing at the melting point showed the form of the tube, but it could be crumbled in the hand like a piece of coke or iron oxide, and it is my idea that this tube does not melt, but goes into a partly carbonized state at the melting point, and that the sulphur that has been picked up by the tube is again thrown off in slag. Chips taken from the bottom of the tube showed that they had not picked up any unusual amount of sulphur. While I do not claim to keep out all the sulphur, I do claim to protect the chips from the flames and sulphur to a great extent, and come nearer to melting chips in a protected chamber than has ever yet been made practical.

Arrangement of the Cupola

For convenience in charging the chips a separate door is cut in one side of the cupola away from and, where it is possible, higher up than the charging door. A special platform is built and the chips are fed in from this platform. By this plan the work does not interfere with the men charging; it gives a longer tube to start with, and less trouble putting on tubes after the cupola is in operation. Two nail holes are punched in the sections at each end, and as they are fitted into each other nails are put through to hold them from separating. One part of the charge is liable to settle faster than another, and separate the tubes and allow the chips to run out into the cupola. By holding them together no trouble of this kind will occur, but should it happen you will soon realize what it means to put chips in without confining them, for immediately you will have fireworks most beautiful.

Physical and Chemical Tests

Several heats have been taken for the sole purpose of finding out the true loss and condition of the iron with the following results: One test heat of 18½ tons of iron was made up of 35 per cent. pig iron, 45 per cent. scrap, and 20 per cent. chips. The melted was all pigged, and after careful cleaning and weighing the loss was found to be 4.6 per cent. Six test bars were cast from the first, middle, and last part of the heat and tested for tensile strength and for hardness in our hardness testing machine, in which a small drill is fed through the one-inch bar by a constant weight, and the number of revolutions required to go through the bar are counted. The results are given in Table 1. Another test heat was made of 16½ tons of iron containing 42½ per cent. pig iron, 47 per cent. scrap and 10½ per cent. chips. The total loss in this heat amounted to 3.8 per cent. Six test bars were again taken from the first, middle and last part of the heat, and

tested as before with the results given in Table 2.

Comparison with Melts without Chips

The first of the above tests was made in a 42-inch cupola in which iron is melted for small work, and must be soft. The average run of iron melted in this cupola containing the same proportions of pig iron and scrap, without chips, shows a tensile strength from 23,000 to 25,000 pounds per square inch, and hardness from 325 to 375 revolutions. The second test was made in a 66-inch cupola which is used for the large class of work. The standard bars of the regular mixture, without chips, from this furnace show a tensile strength of from 24,000 to 26,000 pounds per square inch, and a hardness from 300 to 400 revolutions. It will be seen that, while the hardness of the chip mixture was not increased, the iron had gained from 3000 to 5000 pounds tensile strength per square inch due to the close grain of the iron. The reason for this close grain is due to the changes that take place during the process of melting. As has been stated before, these chips, being in such a fine state, a great deal of the graphitic carbon is shaken out in the handling during transportation from one place to another, but, besides this, the remaining graphitic carbon being exposed to the heat on the surface of each little chip, part of that is burned up, reducing the amount of total carbon in the molten iron. Moreover, the protection of the chips from the fuel and gases by the tube, which does not permit an excess of sulphur to be absorbed by the iron, the natural separation of the greater part of the carbon into the graphitic state takes place, with the result that the total carbon in the iron is lower while the combined carbon remains about the same. To prove this we have melted down some borings alone, that is, in the regular way with the tubes. A sample taken from this iron analyzed as follows: Total carbon 2.43 per cent., graphitic carbon 2.01 per cent., combined carbon 0.42 per cent. The average carbon contents in the iron from the regular mixture without chips will show from 3.30 to 3.60 per cent. of total carbon, thus showing a reduction in the remelted chips of about 1 per cent. of the total carbon.

From the above it will be seen that the use of chips by the Prince process reduces the total carbon without increasing the combined carbon, thus making the iron closer in grain by the reduction of the total carbon, and not making it any harder since the combined carbon is not increased, it being a well known fact that the hardness of the iron is proportional to the amount of combined carbon present. The cost of the pipe is $1.40 per ton of chips melted which is about the total as the cost of handling is no more than, if it is as much as, that of disposing of the chips in any other way.

The illustration shows the two cupolas in which the process is carried out, the tubes and outlines of the charging doors being painted white for greater clearness. The two tubes will be seen at the left through the main charging door of the larger right-hand cupola* while the top of one of them will be seen through the upper door of the left-hand cupola. The platform from which the chips are charged is between the cupolas and on it are two sections of tube, also painted white. A chain hoist is fitted for hoisting the bodies of the cars on which the chips are brought to the main floor up to this platform. Two workmen on the platform are shoveling the chips into the tube.

*The tubes are located back against the left side of the cupola, not in front of the charging door as might be inferred from the illustration.—Ed.

How Lead Pencils Are Made

By Albert W. Jacobi

Some early facts about the beginning of the lead-pencil industry.

The process of handling the graphite and converting the lumber into suitable shapes.

There are, perhaps, few articles so universally used as is the lead pencil, and of whose history and methods of manufacture so little is known.

Historians tell us that Pliny refers to lead as used for marking lines on papyrus, and that La Moine ruled documents with it is long ago as 1387; Cortez found the Aztecs in 1520 using crayons made of it. The lead here referred to was undoubtedly metallic lead.

Shortly after the discovery of the famous Barrowdale graphite mines in Cumberland, England, in 1564, lead pencils became a reality. There is a story to the effect that the first lead pencil, approaching in looks and general character the present article of commerce was made by a girl in Danvers, Mass., who in some way succeeded in getting hold of some graphite from the English mines, pulverized it, and after mixing it with gum or some other ingredient for a binder, forced it into an elder twig, from which the pith or pulp had been removed. This girl was the inventor of lead pencils, and to her everlasting memory a monument should have been erected years ago.

The Barrowdale mines were not destined to last forever, in spite of the fact, that, according to an act of Parliament, their entrances were closely guarded, and the mines were only worked six weeks during the year. The balance of the year they were flooded with water to prevent entrance and in 1850 became exhausted.

The original method of preparing graphite for use was by dividing it into strips, after it had been pressed into blocks, which were made from pulverized graphite.

Near the close of the Nineteenth century, a Frenchman, Conté, of Paris, invented a process of preparing lead which closely resembles that now in use. This process consisted, briefly, of mixing pulverized graphite and clay in varying proportions, depending upon the grade and degree of softness or hardness desired, the larger the amount of graphite, the softer the resultant lead, and the greater the amount of clay the harder the lead. While Conté, the Frenchman, originated this process, it remained for the Germans to perfect it. This they accomplished so well during the first part of the last century, that Germany may well be called the home of the modern graphite pencil.

In America a number of Yankees tried their hand at the pencil business in the early part of the last century, and reliable authority credits Joseph Dixon with having made commercial pencils as early as 1830.

Manufacture of the Lead

The early workers in the industry discovered that a holder or supporting element was necessary, and the result was, that from the girl's idea of an elder twig grew the strips with the half groove, two of which are combined to form a pencil. After numerous trials and experiments with various woods, cedar was finally selected, as it is comparatively soft, has a straight grain and was found in abundance in the southern part of this country.

The preparation of the graphite, more than any other part of the pencil, requires the greatest possible care and attention.

The finest grades of graphite procurable are selected for pencil use. Graphite is found in varying qualities and quantities in all parts of the globe, the largest deposits being on the island of Ceylon. The United States consumes from 30 to 40 per cent. and produces about 20 per cent. of the world's graphite. Only a small part of this, however, goes into pencils.

The graphite is generally received in lump form from the mines, and after passing through different machines in its

reduction, it is screened in a manner similar to other ground or pulverized substances.

After this dry process of reduction is completed, the material is run through what is known as the wet process of grinding. Next it is washed to remove impurities, and finally it is passed to the settling basins, where the various degrees of fineness are secured. The graphite and water, in heavy liquid form, is then passed through filter presses, after which it is practically ready to mix with the proper amount of clay for the different grades. The clay, most of which comes from Austria and Germany, while it need not be pulverized or ground the same as graphite, must pass through a very careful washing process so that all grit is removed. The same method of filtration used with the graphite is used with the clay, after which the mixing and pressing follow. The quality of the pencils depends upon the thorough mixing and compressing of the graphite and clay, after it has been properly washed.

Forcing It Into Shape

After the graphite, clay and water are thoroughly mixed in the proper proportions, the material is in a plastic state or condition. It is now forced through various dies, under hydraulic pressure, the object being to thoroughly mix it, to exclude all air, and make the material as dense as possible. After passing through the final die, it comes out in strings, resembling the old-fashioned round shoe laces, in bunches. It is next straightened, and after air drying, is cut into lengths, placed in sealed crucibles and baked for a number of hours in a furnace, having a temperature of 2200 to 2500 degrees Fahrenheit. After being assorted it is ready to be placed in the wood.

The lead for the various colored pencils or crayons are produced in a manner very similar to that of the graphite, except that china clay is used and that they are not baked and that instead of using graphite, colors or pigments in powdered form are used. The same care and attention are, however, necessary to produce a high-grade colored lead. Instead of the burning process used in the manufacture of the lead or graphite, colored leads or crayons, after being cut of the ordinary lead or graphite pencil, to length, are subjected to a wax treatment. This gives them the smooth action without which they would hardly receive the approval of the public.

Putting in the Wood

The wood, almost exclusively cedar, is cut from the log as near to the point where it is grown as possible. The average size of a "slat" is only 7/32x2¼x7¼ inches.

After being kiln dried for about 30 days, the slats are taken to the machine rooms, where they are planed on one edge and one side or face machined and the grooves cut.

The leads are next inserted, and two boards or slats glued together, forming a block of from 2 to 12 pencils, depending upon the size, form and number that are to be cut out of a block.

Often in glueing operation the blocks have their ends squared off on automatic machines, constructed for the purpose. The blocks are now ready to be shaped or formed into pencils; round, hexagonal or any other form desired.

In most establishments high-grade pencils are still polished by hand, as no satisfactory machine method has, as yet, been introduced. Many of the better grades of pencils are covered with from 6 to 10 coats of paint and varnish.

Many of the highly colored pencils pass through numerous hand operations before passing to the heading and shouldering departments. Here the heads and shoulders of the pencils are given their final finish. One end is always left blank, while many brands must be shouldered on one end, to receive the metal tips. Pointing the cheaper grades of pencils is generally looked after in this department.

Stamping is another very interesting operation, and the amount of aluminum and gold leaf used in a large pencil plant would surprise anyone unfamiliar with the subject.

For the tips sheet metal is, by the aid of draw presses, changed from a flat sheet to a tube, and these tubes are cut, nurled, nickeled or colored and polished, after which they are attached to the pencils previously prepared to receive them. The rubber used for plugs is received in crude form from various parts of the world, mainly South America and Africa. After soaking it in hot water long enough to soften and remove all surface impurities, it is refined by the rolling and kneading process. It is next mixed with various ingredients to produce the desired grit, after which it is reduced to small-sized pieces, depending upon its final finished form and size, next vulcanized in molds of various forms, tumbled and assorted. The rubber plugs are then delivered to the plugging machines where they are inserted in the tips previously attached to the pencils.

A Countershaft Instruction Plate for the Lathe

Although the countershaft is an important part of the machine, it is quite apt to be neglected; if not left entirely alone, it often receives the minimum of attention. The items of lubrication, adjustment of frictions, etc., are as much entitled to consideration in connection with the countershaft as with other members of the machine equipment. In this connection, a neat brass instruction plate that the Lodge & Shipley Machine Tool Company, of Cincinnati, Ohio, is attaching to the head-gear covers of its "Patent Head" lathes and to the frames of the countershafts for these lathes, should be of interest.

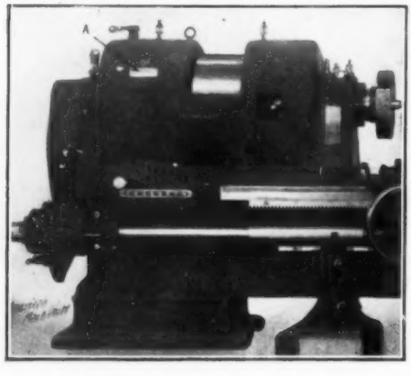

Fig. 1. Lodge & Shipley "Patent Head" Lathe with Instruction Plate on Gear Cover

The plate is shown on the lathe head at *A*, Fig. 1. It is reproduced nearly full size in Fig. 2, its actual dimensions being 1¾x4⅞ inches. At the right-hand side will be seen an outline representation of the countershaft friction, with adjusting nut, operating spool, etc., while the other half of the plate contains a half dozen lines giving in very few words all the instruction necessary for the proper adjustment of the countershaft friction.

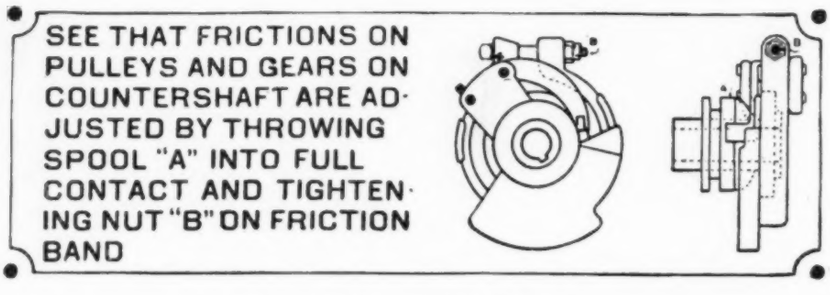
SEE THAT FRICTIONS ON PULLEYS AND GEARS ON COUNTERSHAFT ARE ADJUSTED BY THROWING SPOOL "A" INTO FULL CONTACT AND TIGHTENING NUT "B" ON FRICTION BAND

Fig. 2. The Countershaft Plate

Finding the Value of "E" for Springs

By George F. Summers*

A simple test by which the quality of the material may be determined so that accurate results may be obtained in designing new springs.

A sample spring is compressed by a known weight, and the deflection measured. By applying these figures to the well known spring formula, the value of the torsional coefficient of elasticity is easily found for future work.

*Chief draftsman, Rock Island Arsenal.

In an excellent article on springs, published in the AMERICAN MACHINIST, August 18, 1892, and since copied into Kent's pocketbook, three values were given for the modulus of elasticity: 10,000,000, 12,000,000 and 14,000,000. As doubtless a good many readers would be at a loss to know which figure to use, the following method and pictures are presented, as being of general interest.

In computing the properties of a new spring, the best way to do is to hunt around the shop and find an old spring as nearly like the new one as you can find; test the old spring and, with the results of your test, work the spring formula backward to get the constants to use for the new work. In this method a slight error in the formula will not be noticeable.

The first illustration, Fig. 1, shows a rig for measuring small springs. It consists of two wooden trestles and a faceplate borrowed from a lathe. A small steel rod runs down to a cage below, the cage being loaded with pig lead. As more or less lead is added, the hight of the spring is read very accurately with a micrometer caliper.

Fig. 2 shows a larger spring being weighed up. The side rods are part of a belt tightener. Care must be taken to subtract the actual weight of the spring from each reading. The threads of the rods cannot be used to measure the hight

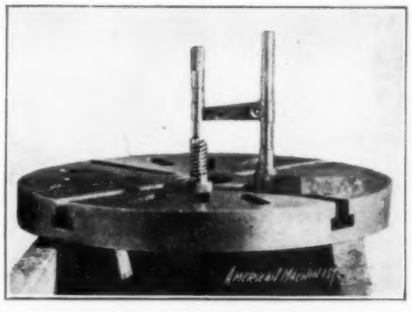

FIG. 1. CALIBRATING A SMALL SPRING TO FIND COEFFICIENT OF ELASTICITY

as the bend in the top board is enough to throw you off.

The following simple, approximate formulas come directly from those given by Begtrup and are derived from the torsion of a bar:

W = Any load in pounds;
S = Fiber stress for load W, pounds per square inch;
M = Deflection in inches for load W;
d = Diameter of wire in inches;
D = Outside diameter of coil in inches;
H = Solid hight in inches = number of coils $\times$ d;
E = Torsional modulus of elasticity;

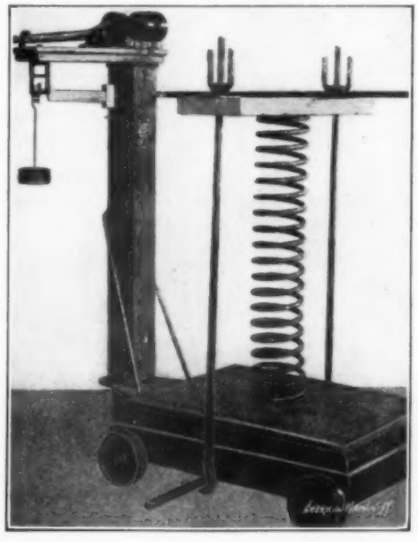

FIG. 2. TESTING A LARGE SPRING

$$W = \frac{\pi S d^3}{8 (D - d)};$$

$$M = \frac{\pi H S (D - d)^2}{E d^2};$$

$$E = \frac{8 H W (D - d)^3}{M d^5};$$

$$S = \frac{8 W (D - d)}{\pi d^3}.$$

For example; suppose $D = 6\frac{3}{8}$ inches, $d = \frac{11}{16}$ inch, coils = 19, free hight = 40½ inches, solid hight = $19 \times 11/16 = 13\ 1/16$ inches. On compressing the spring we find at 39 inches the pressure is 129½ pounds, and at 35 inches it is 475 pounds. Lay off (Fig. 3) $AB = 13\ 1/16$; $AE = 40\frac{1}{2}$; $AD = 39$, and $AC =$ CE, at any convenient scale. Erect the perpendiculars AK, BJ, CH and DF. At DF lay off its pressure, 129½ pounds, to establish the point F and, in the same manner, $CH =$ 475 pounds to find H. Draw a line through E, F and H, to J. Draw JK parallel to AE. The line JE should be straight if you have made no mistakes. Draw GF parallel to AE. $GF = 39 - 35 = 4$. $GH = 475 - 129\frac{1}{2} = 345\frac{1}{2}$. That is, the line in advancing 4 inches rises 345½ pounds; therefore, in advancing one inch it will rise $345\frac{1}{2} \div 4 =$ 86.37 pounds and in 27 7/16 inches ($40\frac{1}{2} - 13\ 1/16$) it will rise $27\ 7/16 \times 86.37 =$2370 pounds, the load at solid hight.

The fiber stress at solid hight is found as follows:

$$S = \frac{8 \times 2370 (6\frac{3}{8} - \frac{11}{16})}{3.1416 \times (\frac{11}{16})^3} = 105{,}600.$$

The value of E is found as follows:

$$E = \frac{8 \times 13\frac{1}{16} \times 345\frac{1}{2} \times (6\frac{3}{8} - \frac{11}{16})^3}{4 \times (\frac{11}{16})^5} = 10{,}800{,}000.$$

The fiber stress of a spring may run from 60,000 to 150,000 pounds per

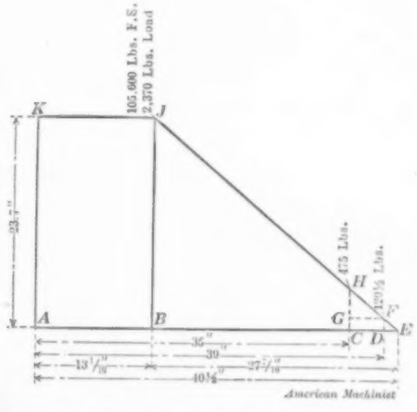

FIG. 3. GRAPHICAL REPRESENTATION OF SPRING CALIBRATION

square inch. For car springs and springs where damage might result from their breaking, 60,000 pounds is a good figure to use. For small springs and for places where no harm will result from the spring breaking, 100,000 pounds will be found satisfactory. For exceptional cases the fiber stress may be run over 100,000 pounds on large work, but difficulties will be experienced, because if the spring is tempered too hard it will break, and if too soft it will go past its elastic limit and take a permanent set.

An application of a solution of picric acid in water for burns, where the skin is not broken, is reported to relieve the pain to a greater extent than most other remedies commonly used for the purpose. It has the effect of hardening and toughening the skin so that the blister does not readily break but forms a natural protective covering.

Embossing a Micrometer Frame

Editorial Correspondence

An interesting example of the cold flowing of metals under heavy pressures.

The small figures of a decimal-equivalent table are raised into the die so that each is very distinct and readable, showing a much easier flow than might be imagined.

This stiffens the frame and gives a grip similar to nurling.

The illustrations show the method used by the J. T. Slocomb Company for embossing the table of decimal equivalents on the frame of their micrometer, a decidedly novel process which was pronounced impossible by some whom they consulted in regard to it.

Fig. 1 shows one of the frames both before and after embossing. A close examination will show the clear-cut figures as well as the clean lines all around the raised edge.

The embossing die consists of three parts, as can be seen from Fig. 2, these being shown in position in Fig. 3. The central portion is simply a retaining die for the edge of the micrometer frame, the metal being prevented from spreading by the outlines of the bow in the center piece. It will be seen that the embossing portions of the upper and lower die reach into the central portion, so that there is no opportunity for the metal to flow in any direction except as controlled by the dies themselves.

FIG. 1. FRAME BEFORE AND AFTER EMBOSSING

Starting with a blank 0.210 inch thick, the edge is raised and the decimal equivalent forced up on each side to the following dimensions for the finished frame. After embossing the flat surface at the base of the figures is 0.193 inch thick and the thickness at the raised edge is 0.220 inch, while the tops of the figures are 0.210 inch. This gives some idea of the flow of the metal under the pressure of the dies.

The pressure varies from 300 to 325 tons, which gives a pressure of about 100 tons per square inch of surface when both sides are considered.

This makes a particularly stiff frame and is a nice piece of embossing. Users of the micrometer liken the feeling to that of a nurling which allows the frame to be easily held between the thumb and fingers.

An idea if the size of dies and the micrometer frames can be secured from Fig. 2, where a two-foot rule is shown folded on top of the central piece of the die.

F. H. C.

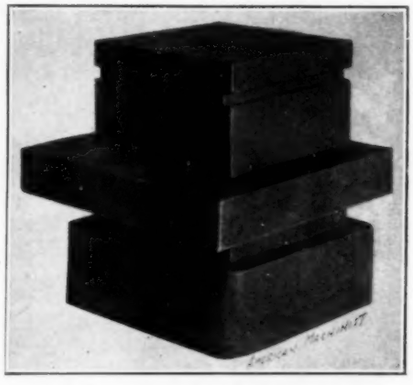

FIG. 3. THE DIE IN POSITION

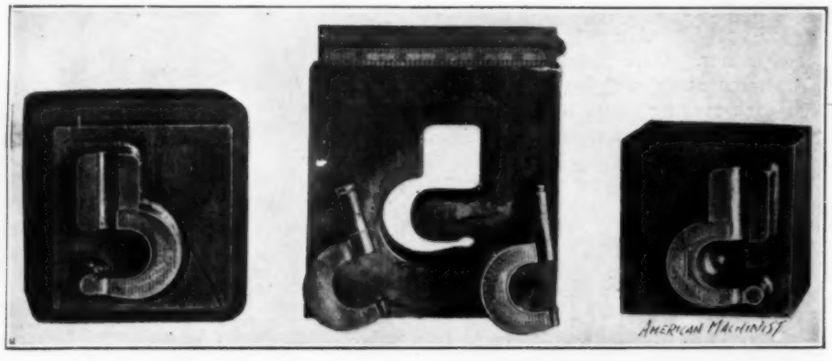

FIG. 2. THE DIES FOR EMBOSSING THE MICROMETER FRAME

Buying Machines That Fit the Work

BY R. E. MARKS

There's a whole lot in knowing what you want to do with a machine or what a user may want to do with a machine, before you either invent or build one. There are plenty of machines built by individual firms for their own use, which could be greatly improved, but the market would not be over 13 machines a year at most, so that it doesn't pay to waste much time or money in that direction.

While I was in old man Jackson's shop the other day a young salesman came in to show him the beauties of the latest style of piano-front lathe, with both the music-roll and the soft-pedal attachments.

He'd been taking points from Hubbard and Sheldon on the enthusiasm game for salesmen, and was just bubbling over with it. Worst of it was that he really believed the misinformation he was handing out to his prospects.

"With our new geared feed box you can get 57 varieties of feeds in just 17 seconds—your men do not waste any time—your output goes up steen hundred per cent., and—"

"Just a minute, son," says Jackson. "See that motto," and he pointed up over his desk. It was the one which reads:

* * * * * * * * * * * * * * * *
* A camel can go nine days *
* without a drink—but who the *
* ——— wants to be a camel? *
* * * * * * * * * * * * * * * *

"But I don't see what that has to do with my lathes."

"Of course you don't, son, or you wouldn't have given me that line of talk about your feed box. I don't doubt for a minute you can make 57 or even 58 changes of feeds in 17 seconds, but who in blazes ever wants to do it? If I ever catch a man using more than four different feeds in this shop, we have a little heart to heart talk at once and he usually hands over his resignation in about 15 minutes. Fact is, I've fixed most of my lathes so he can't get over three feeds anyhow. There is mighty seldom any excuse for using less than a sixteenth feed and my work will not stand over a three-eighth feed at the most, so I put a three-sixteenth in between and we get along fine."

"Yes, Mr. Jackson, but think of the time your men spend in changing gears for cutting different threads. Now with this feed box they can get any thread in a couple of seconds."

"True again, my son, but how often do you suppose they cut a thread on the average lathe in my shop or the average shop? Only two lathes in my shop ever cut a thread and they cut a hundred pieces with the same pitch before making a change. Don't you suppose I can afford to have them spend even a minute and a half to change the gears, say, every day (which they don't do), rather than pay the price of your music-box feed and waste the power it takes to drive it or keep it in repair?

"Now don't get the idea that I think that lathe of yours isn't any good. I know it's well built, because I know who builds it and how he does it, and there is a field for such a lathe in shops which have a variety of work that requires quick changes of feeds and where many different threads are cut.

"Although none of us want to be camels, we take off our hat to him when it comes to hiking across a desert country where thirst parlors are few and far between. In his place he has the automobile beaten to a frazzle, but you and I would prefer the benzine buggy for a Sunday afternoon ride with the missus.

"Now, if you had talked quick-speed changes it would have come nearer hitting my work, for I have some places where it would save time to have a quick and easy way of changing the speeds. But even this is more important on turret-lathe and similar work than on the engine lathe, because there is a much greater variety of cutting to be done. We have a comparatively small hole to be bored and tapped in the center, a wide flange to face which requires much slower speed and probably one or two intermediate sizes to turn and perhaps thread.

"We can afford to pay for devices which will do this without too much delay from breakdowns and without too much power loss. Not so much on account of the cost of the power as that it always means a lot of wear somewhere, which must be replaced sooner or later, generally sooner.

"If you want my advice, which you probably don't, you'll study the conditions in the average shop a little more carefully, so as to have an argument that you can clinch and hammer down when you find the man who needs your lathes.

Don't try to impress a man with a lot of features which he doesn't want anyhow, but which he might put up with if the rest of the lathe was what he could use.

"Just remember that in most shops a lathe is for turning a moderate amount of stock, accurately and quickly. The fact that it will rip off 175 pounds a minute only interests the forge shop or some similar place, and it tells him at once that the lathe is heavier than he needs for his work, and probably not as convenient to handle.

"And, above all, don't try to sell a man what he has no use for. If you feel that he can use your lathe to advantage, make him see it that way too, and cinch his order. That salesmanship. But don't make him believe he needs something which you know he doesn't. That's obtaining money under false pretenses. It isn't good business and it counts against you in the long run."

Seems to me old man Jackson has missed his calling.

Profit Sharing Plan of the Brooklyn Edison Company

The recent action of the Brooklyn Edison Company in announcing a profit-sharing and pension system has evoked both favorable and adverse criticism; the optimist regards it as a substantial recognition of the employee's right to share in the profits of labor, while the pessimist can see in it only a scheme to keep the men in a state of virtual serfdom under the guise of pretended benevolence. In spite of whatever grounds these extremists may find for basing their contentions, the plan is to be commended more than condemned.

The avowed purpose of the plan as set forth in the company's announcement to its employees is "a recognition of faithful and efficient service and the encouragement of thrift and investment in the securities of the company." Reading between the lines shows the first part of this statement to be a purely business proposition; the company in return for a bonus expects to receive better service, to make the employees feel a personal interest in the company, thereby eliminating one great source of waste, and to retain their employees for longer periods of time, in this way doing away with the bother and loss in efficiency through continually breaking in new men.

The terms stipulate that those who have been with the company two full years shall receive a percentage of their wages for 1910 equal to one-fourth of the rate of dividends paid on the capital stock of the company during the past year; those who have been with the company three, four and five years shall receive, respectively, one-half, three-fourths and the full rate of dividend. The money, however, cannot be withdrawn by the employee within three years, except in special cases; but instead is deposited to his credit with the Brooklyn Edison Investment Fund, he receiving only the interest upon the dividend. Expressed in dollars and cents this would be as follows:

Assume that a fireman has been in the employ of the company for three years. His wages amount to $910 per year and if the rate of interest on the capital stock is 8 per cent. (a fair estimate based upon the figures of past years), his share of the profits would be $36.40; but as this is turned over to the Investment Fund, he would receive only the interest which, at 5 per cent., would amount to $1.82 one year from this January. A watch engineer under the same length of service would have $58.24 placed to his credit and would receive $2.91. At the expiration of six years of service the fireman would be entitled to withdraw $163.80 and still have 72.80 to his credit, which latter sum he would receive annually thereafter. This would be equivalent to an increase in weekly wages of $1.40.

Although these figures may appear insignificant, their fairness, after five years of service, cannot be questioned. If a man's labor be considered as part of the working capital of the company, and providing he receives equitable wages, his share in the profits is obviously a percentage of his yearly wages equal to the rate of dividend paid on the capital stock of the company.

The production of iron and steel plate for the manufacture of cut nails and cut spikes in 1909 amounted to 63,746 tons, against 45,747 tons in 1908, an increase of 17,999 tons, or over 39.3 per cent. Of the total production in 1909 about 47,822 tons were steel and about 15,924 tons were iron, against about 30,265 tons of steel and about 15,482 tons of iron in 1908, an increase in steel nail and spike plate of 17,557 tons and in iron nail and spike plate of 442 tons.

The production of all kinds of iron and steel rolled into finished forms in 1909, including rolled forging blooms and rolled forging billets, amounted to 19,644,690 gross tons, against 11,828,193 tons in 1908, an increase of 7,816,497 tons, or over 66 per cent.

Laboratory of Ludwig Loewe & Co.

By Bertold Mitan *

The first materials-testing laboratory established with an European firm building machinery exclusively. The apparatus used and materials and products investigated.

*Chief chemist of the firm.

The greater the requirements placed upon the product of any process of manufacture, the more perfect must be the means of complying with them. Everything in any department of human knowledge which in any way appears capable of facilitating the attainment of this object, should be availed of for a constant improvement of the output.

But this is not all that has to be done in the manufacture of a mechanical product: In order to keep the factory alive the product must be sold, for which purpose it is before all things necessary that it be marketable; that is, that its price shall not be greater, and if possible shall be less, than that of competing goods satisfactory to the consumer. The problem, therefore, today set before almost all manufacturers is to sell for the least money.

FIG. 1. PART OF THE CHEMICAL LABORATORY OF LUDWIG LOEWE & CO.

It is, therefore, necessary, with a view to cheapness as well as to perfection, that all these products of the human brain shall be tested to see whether they comply with the useful purposes for which they are intended.

There can be no doubt that, as for every other branch of manufacture, so also for machine construction, with which the following discussion is concerned, the selection of a raw material, suitable both in technical and scientific ways to the successful solution of the above indicated problem is of extreme importance to every manufacturer, and he must, therefore, select with greatest care the raw materials which he uses. It is not sufficient that the raw material purchased undergo a subjective judgment by certain employees—even those who themselves are later to use it—but in all circumstances resort must be had to a thorough objective judgment as to the serviceability and value of the material. In order to arrive at this, however, there is only one way: use must be made of all means afforded by the latest science, primarily of chemistry, physics and metallography (the microscopic investigation of the minute structure of the metal) in order to conduct a strictly scientific examination of the material.

FOUNDING OF THE LABORATORY

From the foregoing principles, some large German establishments, managed according to modern ideas, have instituted special departments which are devoted to a fundamental scientific investigation of the raw materials and products of the works. The first in Germany, and perhaps in Europe, among machine shops not connected with any furnace plant, which entered upon this policy, was the firm Ludwig Loewe & Co., Actiengesellschaft, Berlin. As long ago as 1899 this firm equipped at its new Berlin works, then going into operation, a material-testing department proper and laboratory. This laboratory has now existed almost 12 years, and in the course of that time there has been built for it a new structure more than quadrupling the space. In its early years this laboratory must have aroused a good deal of criticism and have been pronounced a scientific humbug, but a good many of the leading German machine shops have since followed the Loewe example and numerous works which were not large enough to establish laboratories for themselves have recognized the necessity of constant material tests for which purpose they are resorting to outside assistance. These facts sufficiently vindicate the Loewe policy and render the methods of interest to our machine builders.

MATERIALS AND PRODUCTS TESTED

Naturally the first rule of a laboratory is to make its investigations useful as far as possible. Perhaps its most important function is to deal with raw materials, but it also has to test half finished and finished products beside making researches looking to the improvement of manufacture in mechanical and scientific ways.

Let us see first how raw-material tests are conducted. It is a principle to test all materials that the shop procures in any considerable quantity, such as steel, foundry iron, casting metals, alloys, cupola coke, power-house fuels, oils and other lubricants. With all these materials the results of the test are taken as a basis for acceptance or rejection of individual deliveries or at least for a modification of the price.

For each individual kind of steel there have been worked out at the laboratory certain requirements as to its chemical composition, namely, the carbon content, maximum percentage of deleterious elements such as sulphur, phosphorus, etc.; for many kinds of steel are prescribed also the tensile strength and elongation, while for tool steels, which are purchased almost exclusively in annealed condition, is laid down the further requirement that their microscopic structure shall be regular, which is a criterion whether the annealing has penetrated well through them. If any sort of steel is delivered, the official in charge of the steel stock room sends a test piece from a bar of each size to the laboratory, where are conducted the chemical, physical and metallographical tests to find out whether it meets the prescribed conditions. The stockkeeper is bound not to regard the steel as at his disposal until it is passed by the laboratory.

From each carload of pig iron is taken a sample for analysis. The same is true of coke. If the German founders are not powerful enough to dictate to the coke ovens permissible maxima for ash and sulphur contents, still the constant tests of Loewe enable that shop to procure far better coke than would be possible without such investigations. If a delivery of coke is not satisfactory the maker is informed of it and is likely to be more careful in the future. If he remains obdurate another source of supply will be looked for.

The coal burned in the power house is tested to determine its heating value, ash content, etc. In the coal trade there is coming to be a requirement on the part of large consumers that the sellers guarantee a minimum heating value, conditioned upon a reduction of price if not complied with. Since Loewe is more or less following this policy, the laboratory tests of coal are especially important.

Oils and other lubricants, are, as already indicated, subjected to tests in the laboratory, since it is an open secret that in the oil trade a good deal of advantage is often taken of the customer. To prevent this all oils, etc., purchased are thoroughly tested. These tests, for mineral oils derived from crude petroleum, extend to the determination of physical value (specific gravity, fire and flash points, viscosity, etc.) The so called fat oils of vegetable or animal origin, which are considerably more expensive, undergo suitable chemical tests as to their purity. Thus the mineral oils are verified for practical value and fat oils are protected against adulteration.

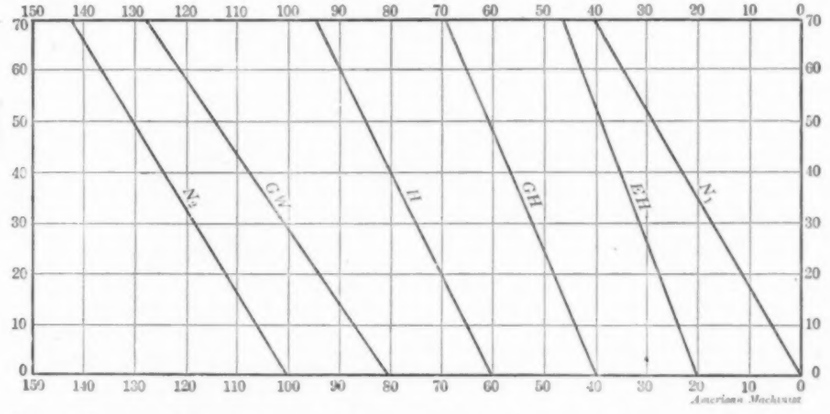

FIG. 2. TYPICAL CURVES FROM HARDNESS-TESTING MACHINE, USING THE DRILLING PROCESS

In respect to the testing of half finished and finished products, it may here be remarked that, for example, the laboratory examines all pieces with which either the hardening room does not succeed, or which after having been treated by it, are rejected by other departments or by customers as hardening failures. The laboratory then determines with absolute certainty where the fault lies, whether in unsuitable material or in wrong treatment, or whether, as comes often to pass, the accusation is unfounded and the piece has only failed under excessive stress.

A further function of the laboratory is physical testing of cast iron. Every melting day a sample from each sort of iron cast is subjected to a bending rupture test. Chemical analysis is also resorted to and assists future charging and control of the cupola furnace.

The castings made in the foundry are subjected to tests to determine their strength and hardness. For the hardness determination is employed a Brinell ball apparatus and there is also used a drilling machine of Loewe construction. Tests on this machine are of special value when castings made in the foundry are criticized by other departments, or by customers, as being too hard and it is desired to ascertain whether the objections are well taken.

THE LABORATORY BUILDING

The Loewe laboratory occupies the first and second stories above the ground of a special building whose ground floor is used for foundry-office purposes. This adjoinment of the office and laboratory under one roof has been found useful for facility of communication between these departments.

In the first story are principally the rooms for physical and metallographical investigations:

1. A room for strength and hardness tests in which is a large testing machine of 50 tons capacity, also the drilling machine above mentioned and a hydraulic press for the Brinell ball determinations of hardness.

2. A room for calorimetric investigations (heating-value determinations) where also is performed the etching required in metallography.

3. The main machine room of the laboratory, containing several tools driven by a five-horsepower motor and used to prepare the metallographical specimens. These include a shaper, a cold saw and a grinding machine, beside a drilling machine to produce chips for chemical analysis and a blower to furnish the compressed air required in the laboratory.

4. A very bright room with northern exposure, which is equipped, first, with a small polishing machine to finish the surfaces already roughed off for microscopic examination. It is separated from the tools already used on these specimens in order to escape their dust. This room contains also a number of excellent microscopes for observation of the polished specimens by reflected light and a microphotographic outfit. On the first floor of the laboratory building we also find:

5. A room for thermal experiments; for example, to determine the melting points of metals and alloys. There, too, is an electric furnace and very accurate instruments for measuring temperature. On this floor is further:

6. A dark room for photographic purposes. Finally there is a metallographic office and a room for correspondence and laboratory records.

The second story of the laboratory building is primarily intended for chemical analysis. We find in this a spacious main working room, about 7x18 meters (21x55 feet) in size, a view in which is given in Fig. 1, and which is well equipped with the requisite apparatus, regard being had to the simultaneous performance of the greatest possible number of similar analyses. This floor contains further an incinerating room with a large number of ordinary gas burners, high-temperature gas burners and gas-air blowers; also a room equipped with a muffle furnace and serving as well for electrolytic purposes in the investigation of alloys, with a large switchboard for handling the transformer and storage-battery equipment. Near the incinerating room is a chamber intended for oil tests. Finally in the second story is an office for the chief chemist and a weighing room, placed at the greatest possible distance from the main working room.

DRILLING MACHINE TO TEST HARDNESS

We may now consider in detail the drilling machine used for testing hardness. It consists of an upright drill having an indicator drum for taking a diagram whose ordinates are proportional to the number of revolutions of the spindle, while abscissas are proportional to the depth of hole drilled. In order to bring this about, the pencil is attached to a nut traveling on a vertical screw geared to the spindle, so that the pencil rises in proportion to the number of revolutions turned; the drum being turned in accordance with the vertical movement of the spindle by a cord passing over guide pulleys. The drill is fed by a weight always having the same lever arm. From the diagram we may easily determine the

depth of hole corresponding to a certain number of revolutions under given feed conditions produced by the weight. If, for example, in drilling two different kinds of iron under like conditions, and with a definite number of revolutions, we make in one a hole 20 millimeters deep, and in the other a hole 25 millimeters deep, it is natural to infer that the second iron is softer than the first. On this principle depends the use of the machine.

In order to establish a definite basis, a so called standard iron must be used in all experiments. For this purpose Loewe employs an iron intended for machine castings of medium weight, of which he has cast under the same conditions a large number of test bars. When tests of hardness are undertaken a hole is first drilled in one of the bars of standard iron, after which the test pieces are successively drilled, and finally another hole is made in the standard iron.

In an experiment to determine the hardness of four cast-iron test pieces, there were produced, for example, the curves shown in Fig. 2. The one designated N_1 was made in the first, and that marked N_2 in the final drilling of the standard iron; the curves *E H*, *G H*, *H* and *G W* were formed in boring the four samples of *E H* (extra hard), *G H* (very hard), *H* (hard) and *G W* (very soft) iron. Suppose now for a certain ordinate—the one corresponding to 70 millimeters abscissa, for example, according to the Loewe practice—we obtain the following values:

For the curve marked N_1, 40.2; *E H*, 26.4; *G H*, 29.1; *H*, 34.8; *G W*, 48; N_2, 42.2.

The greater the abscissa, the softer the iron. In order to express this numerically, we may place the hardness of standard iron equal to 100, and say that the hardness of the several kinds must be inversely proportional to their abscissas. We choose an abscissa that shall be as independent as possible of small variations in the hardness of standard iron, the variations always influencing the drilling in the course of a series of experiments, more than the blunting of the drill. In the example before us the curve N_1, although taken later than N_2, has a greater abscissa, which cannot be accounted for by blunting of the drill. We select, therefore, an abscissa for the standard iron, the average values of the two measured abscissas, which is 41.2, and denote by *X* the hardness of the iron *E H*, which we are trying to find. Then we obtain $X \div 100 = 41.2 \div 26.4$, from which $X = 156$.

We obtain, thus, the hardness of the *E H* iron = 156; *G H* iron = 142; *H* iron = 118; *G W* iron = 86.

At the same time we may conclude from the appearance of the curve whether the material is equally hard throughout. If this is the case, the curve naturally takes the form of a straight line. If the iron is soft or porous inside, the curve takes a bend toward the horizontal. This machine has performed well in the Loewe laboratory.

The testing laboratory of Ludwig Loewe & Co. is an example worthy of attention and imitation throughout the trade world, although, naturally, its example cannot be closely followed by shops other than large ones equipped with foundries. The firm stands ready to furnish information concerning its experience in this line which may be useful for others who are thinking of establishing laboratories for themselves.

Locating Schemes for Drill Jigs

By Lucien Haas *

The devices used to locate work in jigs so as to bring each piece into the same position for drilling. Different constructions to be used to suit varying conditions.

*Chief tool designer, Thomas Motor Company, Buffalo, N. Y.

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Many methods are employed to center or locate the work, there being no special design which is best for all cases. The plans shown herewith give a variety of ways in which this can be done and allow the selection of the best for any particular case.

One of the most useful means employed in jig construction for locating or centering the part to be drilled is the V, its construction varying to suit conditions. It is usually operated by means of a screw with a double or triple thread.

Fig. 1 shows a simple construction that is generally used on very small jigs. The V is held down by means of the screw *A* and is also guided by this screw, which is flattened on both sides to fit the slot in V.

Fig. 2 is an improved design, being guided by the two gibs *A* and *B*. The V is held down in the same manner as in Fig. 1 by means of the screw *C*. This design is also used in small-jig construction.

A Cheaper Form

Fig. 3 is practically the same as Fig. 2 except it is a little cheaper to make. It is held down the same way as Fig. 1 but is guided by a tongue instead of the gibs. There is a slot cut in the body of the jig in which this tongue slides.

Fig. 4 is really the standard form of design for constructing these V's as it is strong and accurate. The gibs *A A* should be dowel pinned after being located and should be made of steel. In some instances they are hardened and ground but generally left soft and the V hardened.

Fig. 5 is similar to Fig. 4 except in the design of the gibs, which are dovetailed. This style is more often used in large drill jigs and is, of course, more expensive than any of the others shown, but it has advantages over the others in the way of accuracy and wearing qualities.

Fig. 6 is another form of V which is often used when the design of the jig calls for a limited amount of room, being particularly useful in such cases.

Used on Large Jigs

Fig. 7 is a satisfactory way of making a V for locating large bosses, etc. In this design the V has only a limited amount of movement. It is not very popular and is used mostly on large jigs.

Fig. 8 is similar to Fig. 4 and is only shown to give the designer or toolmaker another method of operating a V. The screw *A* is threaded into the block and held by the two collars shown.

Fig. 9 consists of 2 fingers *A* and *B* which are operated by means of a screw

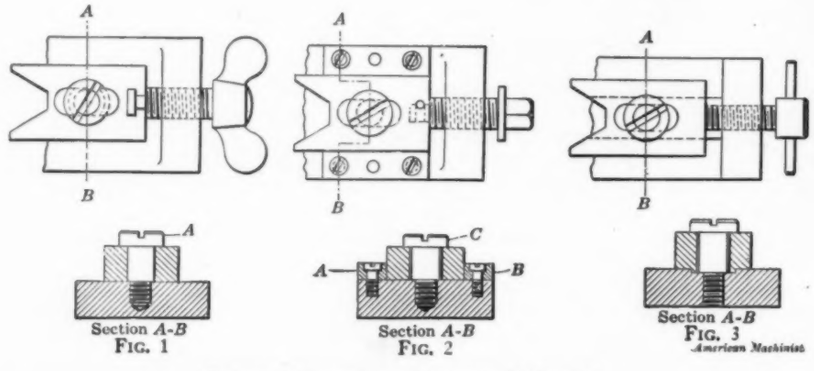


Fig. 1 Fig. 2 Fig. 3

Three Methods of Holding V Blocks

C. These fingers swing on the screws *D* and are brought back to their original position by means of springs *E E*. This is another design used when there is only a limited amount of room in the jig.

Figs. 10 and 11 show two styles of locating V's which are held down in similar ways but are operated somewhat differently, one is operated from the front and the other from the back. The gib in

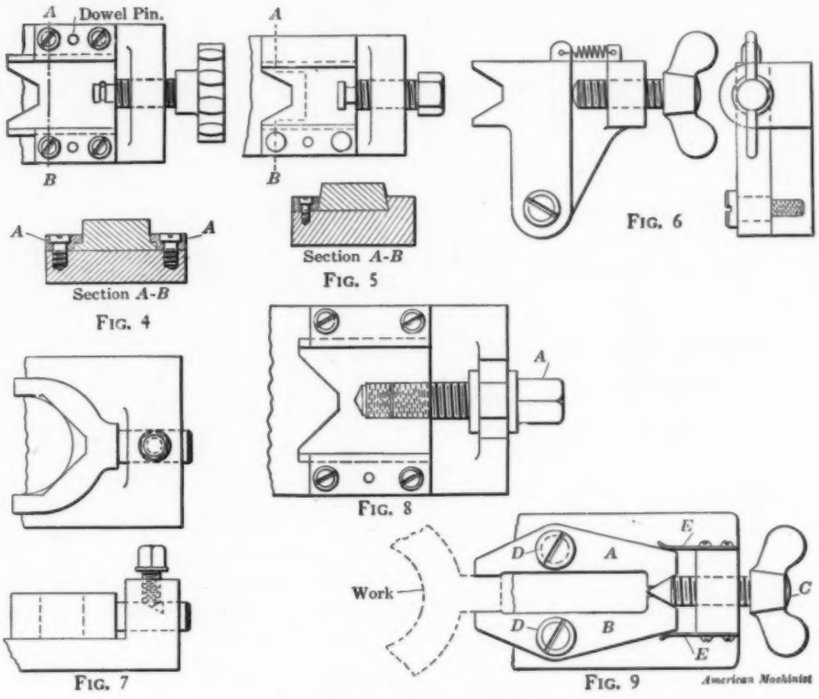


FIG. 4 FIG. 5 FIG. 6 FIG. 7 FIG. 8 FIG. 9

A GROUP OF CENTERING METHODS

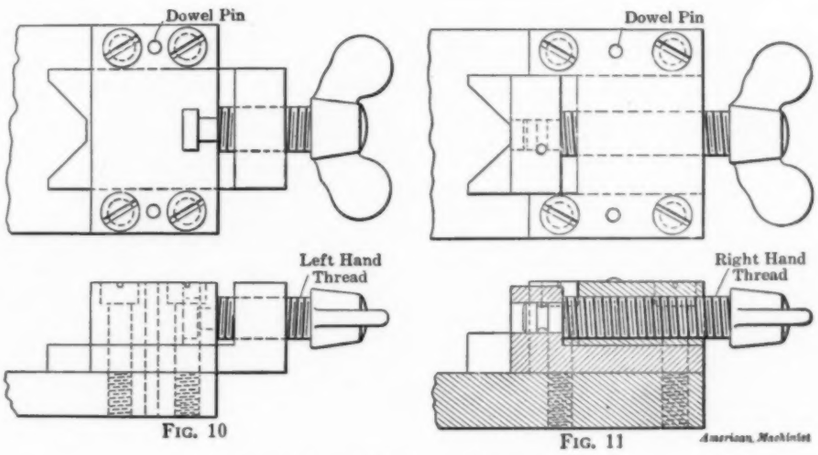


FIG. 10 FIG. 11

TWO MORE WAYS OF MAKING VS

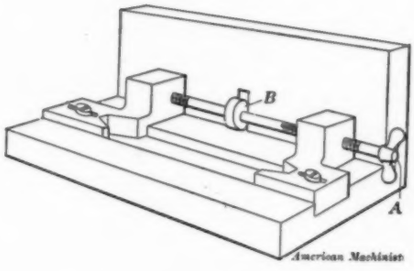


FIG. 12. CENTERING WITH RIGHT- AND LEFT-HAND SCREW

both cases acts as a guide for the V and support for the screw.

In Fig. 12 are shown two V's operated by a screw *A* which has a right- and left-hand thread. The flange *B* in the center of this screw works in a slot which holds it in a central position. The two V's are guided in a slot provided for them in the jig and are held down in the same manner as in Fig. 1.

It will be observed that each of the forms shown, as representative locating devices, possess some advantages for special purposes.

An Expanding Thread Gage

BY G. N. KNOX

It is occasionally necessary to chase threads in the middle of a piece of work, which is to be hardened and ground after inspection. It is obvious, of course, that the stock left on for grinding will not allow an ordinary ring-thread gage to go on.

The pinion and chain shafts of an electric automobile are good examples of this. In order to hold the ball bearings in place it is necessary to bind the inner ring against a shoulder by means of a hexagon nut. As the entire shaft must be hardened and ground, and the part of the shaft on which the threads are chased is to be finished the same size as the threads, an ordinary ring thread gage cannot be used, and the one shown in the accompanying cut was designed. The illustration is clear except, perhaps, the method of operation, which is as follows: The two jaws are separated at *X* far enough to allow the gage to go over the large part and then closed down on the threads. When the two flat parts at

AN EXPANDING THREAD GAGE

X are completely closed and the threads are a snug fit at *A*, the job is done and accurate size is maintained.

It will be seen that the threaded part of the gage is as near the hinge part of the levers as possible. This insures that the distance between the flats at *X* is greater than the over diameter of the screw when measured.

According to bulletin 43 of the Engineering Experiment Station of the University of Illinois entitled Freight Train Resistance: Its Relation to Car Weight, the results of tests made on 30 freight trains in regular service substantiate the usually accepted influence of speed upon resistance. For trains composed of cars weighing 15 tons, on the average, the resistance is shown to vary from 7½ pounds per ton at 5 miles per hour to 13½ pounds per ton at 40 miles per hour; while for trains composed of cars weighing 75 tons, the resistance is shown to vary from 3 pounds per ton at 5 miles per hour to 5½ pounds per ton at 40 miles per hour. These results apply to both homogeneous and mixed trains of various composition, running upon track of good construction laid with 85-pound rail, during weather when the air temperature is above 30 degrees Fahrenheit and the velocity of the prevailing winds is less than 20 miles per hour.

The Kind of Patents Issued

By Jas. J. O'Brien

In his excellent work entitled "The Science of Mechanics," Dr. Ernst Mach says:

"The gist and kernel of mechanical ideas has in almost every case grown up in the investigation of very simple and special cases of mechanical processes; and the analysis of the history of the discussions concerning these cases must ever remain the method at once the most effective and the most natural for laying this gist and kernel bare. Indeed, it is not too much to say that it is the only way in which a real comprehension of the general upshot of mechanics is to be attained."

It is unfortunate that this sound principle is not more generally applied in the treatment of mechanical questions and particularly in the treatment of questions affecting the administration, efficiency, justice and sufficiency of existing patent laws and the established official mechanisms for the transaction of patent business.

Discussions of patent conditions are too frequently characterized by opinions based largely on limited personal observations or experience. It would seem that a survey of the distribution of patents, the methods of patent procedure, external and internal, and the mechanical organization of the patent system would be of vital interest to the larger questions of patent or inventive equity and justice and the growing economic question of restricted development of industrial arts, due to defective patent conditions, laws and practices. The following general survey is accordingly offered as a beginning toward a fundamental study of patent conditions.

From 1790, when the patent system was founded, to July 4, 1836, before the reorganization of the system, a total of 10,048 patents were issued. Most of the records of these patents were destroyed by the first Patent Office fire and but 2236 records were restored. (See volumes 1 to 29, inclusive, of restored patents; also Patent Office report covering period of 1790-1836.) Since the reorganization of the patent system, which followed sensational disclosures, and which resulted in the establishment of the examination system, a total of 956,506 patents have been issued. The total of all patents issued, before 1836 and after, up to and including the issue of April 26, 1910, is 966,554.

A careful analysis of the distribution of the 956,506 patents, issued since the reorganization of the patent system, will show some surprising results.

Under the present classification of the Patent Office all the patents are divided into 248 classes, and into many hundreds of sub-classes. Twenty-seven of these

Under the present Patent Office classification all patents are divided into 248 classes. Of these 27 contain one-third of all patents issued. It is very difficult to estimate the value of a patent, for it may be worthless in its own field, yet valuable in one that is related on even unrelated.

248 classes contain nearly one-third of all the patents issued since 1836, as will be seen from the following table.

Class.	No. of Class.	No. of Patents.	Total.
Carriages and wagons	21	33,080	
Stoves and furnaces	126	16,496	
Buttons and buckles	24	16,395	
Mills	83	16,141	
Plows	97	13,864	
			95,976
Harvesters	56	13,942	
Seeders and planters	111	10,205	
Harrows and diggers	56	7,363	
Harness	54	8,276	
Fences	39	11,144	
Steam engines	121	12,528	
Railway rolling stock	105	13,393	
Railways	104	9,927	
Railway draft appliances	213	9,049	
Water distribution	137	12,846	
			118,673
Measuring instruments	73	12,492	
Games and toys	46	10,13[illegible]	
Sewing machines	112	8,85[illegible]	
Apparel	2	8,20[illegible]	
Registers	235	5,20[illegible]	
Velocipedes	208	6,41[illegible]	
Bottles and jars	217	6,255	
Resilient tires and wheels	152	4,304	
Nut locks and bolt locks	151	3,356	
Railway joints	239	3,714	
Plastic block apparatus	25	5,282	
			78,784
Grand total			293,433

TOTALS IN SEVERAL PATENT CLASSES.

By the above figures, which are taken directly from the Patent Office records, it is seen that five classes of the Patent Office contain 95,976 patents, or nearly one-tenth of all the patents issued since the reorganization; that 15 classes contain 214,649 patents, or nearly one-fourth of all; and that 27 classes contain a grand total of 293,433 patents, or nearly one-third of all patents issued; the balance of the patents, nearly two-thirds of the entire total, being distributed among the remaining 221 classes.

These figures are interesting not only from their statistical value but because they throw a strong light on the inventive activities, or at least the patent tendencies of the nation. It would indeed be interesting to know the chief influences which have impelled the inventors to file most of the applications included in the above totals. To a large degree the common run of inventors are influenced by what they read on patents and on the possibilities of invention along certain lines. They are also influenced by personal observations, which are usually of a limited nature, and which often lead to novel results but to inapplicable devices or structures, which contain sufficient utility to pass the technical criticism of the Patent Office. Yet when it is considered, and it must be conceded by all careful thinkers, that a great part of all initiatory industrial work is either experimental or empirical in nature, we should hesitate about making too sweeping criticisms about the large number of so called worthless patents that are issued. Things that are useless in one way become useful in another way.

Value of a Patent

A large number of the so called worthless patents, that is patents which could not be sustained in court or which possess no productive value in the market, will be found in the above classes, and in such other classes as Class 81, Tools, which includes many thousands of wrenches, and which has 6802 patents.

Every patent should be examined from several standpoints: a patent may be intrinsically worthless and extrinsically valuable. The structure actually disclosed in a patent may be without value and the scope of the claims may give the patent considerable value, whether considered by itself or in combination with other patent values. A patent may be without value, whether considered mechanically or legally, and possess value because it assists in establishing and defining an error and thereby conserving experimental work, or because it suggests near or altogether remote inventions, in any one of the numerous ways a patent or an idea is capable of suggesting new thoughts.

Again, the structure disclosed in a patent may be without value to the particular art it belongs to and may be of value, great or small, to some other art: for instance, a non-refillable bottle may be worthless from every standpoint for the purposes intended by the inventor, yet it may be of value as a check valve, or for some other unrelated or related purpose.

It is difficult, therefore, to accurately determine the number of patents that possess value and the number that may

be considered as without value. In fact a patent may be wholly without value during its life and some economic change occurring after it expires may render the unprotected invention of great value.

While it is true that there is a certain economic limit to what the market can assimilate in new inventions, it is also true that many inventions are simply forced upon society by dint of expensive and persistent drilling and education. This is especially true of many inventions, such as the household wringer and the typewriter, which have come into universal use. It is also true of the fountain pen and other like commonly used devices. When this fact is considered on a large scale and the usual business incompetence of inventors estimated the lessons which the large numbers of unused and unusable patents teach can be better understood. Nevertheless, there can be no question that there is too much wild speculation in the patent system and not enough of that vital inventive work which founds new industries or expands to world-wide proportions old industrial arts, and thereby assists in the rapid expansion of trade. It would even seem to the close observer that the way is much easier for the mere patent speculator than for the hard-working inventor; that the inventor of a fascinating toy or a puzzle or some other device of a transient character has less economic difficulties to overcome than the inventor of a new art or a vital improvement in an old art, which greatly widens the social horizon or vastly enriches the social domain. That this should be so is at once a great tragedy and national problem.

Rapid Roughing of Bevel Gears

Special Correspondence

The use of a multiple attachment to a gear cutting machine so that two or three gears can be roughed out at one setting. This enables them to be prepared for gear planer at a very low cost.

The illustrations show a method being used by automobile manufacturers for the rapid roughing out of bevel pinions and gears for both differentials and transmissions. This is being done on an adaptation of the bevel-gear cutting machine, built by Gould & Eberhardt, Newark, N. J., especially for this kind of work.

Either two or three cutters are used according to the size of the gears being cut, and the work spindles are carried in a special head which fits interchangeably on the platen of the gear-cutting machine. This platen can be raised into any desired position, according to the cutting angle of the gears in question.

The heads carrying the cutter spindle are constructed in different ways, as can

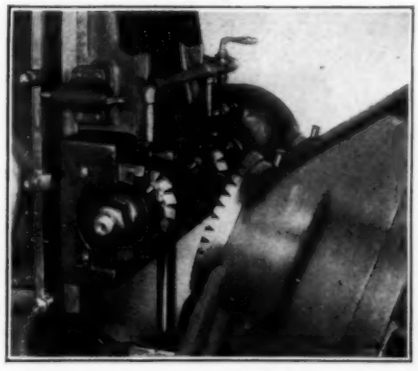


FIG. 1. STOCKING LARGE AUTOMOBILE DRIVING GEARS

be seen in Figs. 1 and 2. In the first, where the cutters must be widely spaced on account of the large diameter of the gears, the cutter spindle is supported both in the center and at each end.

In the other case, the bearings are at the end, but it will be readily seen that the whole spindle can be very easily removed by loosening the cap bolts. In addition to the regular support to the table, which is controlled by a worm-wheel sector, located in a central position and held by a clamping device, the gears in Figs. 1 are provided with a special adjustable brace, supporting the periphery of each flange being cut. This acts as a brace directly back of the face of the gears and also as a chip chute, also directing the oil into the proper pocket in the base of the machine.

The cutter slide is actuated on the draw-cut principle, the feed screw being anchored at the base of the upright, so that all impulses of the cutters are transmitted directly to the base of the machine, and the feed screw is in tension, rather than compression.

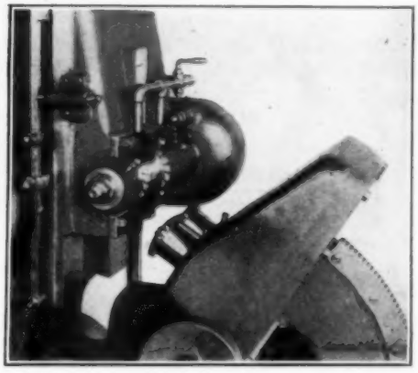


FIG. 2. STOCKING DIFFERENTIAL GEARS

The gears shown in Fig. 1 have 40 teeth and ⅞-inch face, being of 5 pitch. Two gears of this size are roughed out in 34 minutes. The two differential gears shown in Fig. 2 are 7 pitch, 11/16-in. face and contain 24 teeth. These were roughed out in 11½ minutes. The three differential pinions shown in Fig. 3 are also of 7 pitch, ⅝-inch face and have 12 teeth, the three being roughed out in 4½ minutes.

A simple way of arriving at a commercial estimate of the relative value of different tool steels, submitted for purchase to railway engineers and others, is described in the *Zeitschrift des Oesterreichischen Ingenieur- und Architekten-Vereins.* The tools in question, suitably machined, if necessary, as cutters on a disk of steel, about 20 inches in diameter, and 2 inches in thickness, are fixed on a lathe. The disk is perforated in the center, the hole having a diameter of 4 inches. The tools are used one after the other on the disk, which is revolved at a good speed; the cutting is started at the

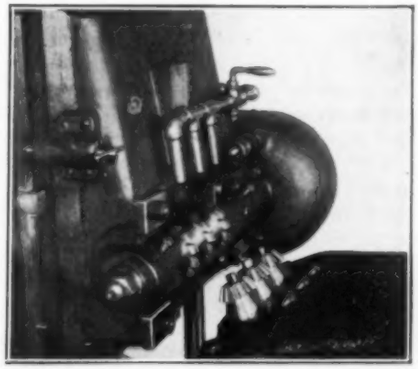


FIG. 3. STOCKING DIFFERENTIAL PINIONS

center, and continued until the tool has become blunt; the better the steel the greater will be the diameter at which the tool fails. Supposing seven steels to be offered, the prices being 690, 580, 575, 590, 550, 800, and 500 kronen per 100 kilograms, and that they fail at diameters of 350, 350, 500, 340, 320, 530 and 340 millimeters, the speeds being always the same; then the quotients, price over diameter, 1.96, 1.65, 1.15, 1.73, 1.71, 1.51 and 1.47, may be taken as indicators of the value, the smallest figure (1.15, the third steel in question) making the best value; the cheapest steel (No. 7) comes second in order, while the most efficient (No. 6) ranks third.

Mechanical Proving of Automobiles

By John Squires *

The uncertainties of road tests, due to weather conditions and the disposition of the test driver, make it evident that uniform results cannot be obtained.

Also, the expense of fitting, wear on tires, final cleaning for paint, and wages of driver make road testing unnecessarily expensive.

An absorption dynamometer, standardized from experimental road tests, gives all data necessary and insures uniformity of all cars. Short road test for steering gear and frames.

*Engineer, Thomas Motor Cab Company, Buffalo, N. Y.

Some time ago we decided that road testing was only a makeshift method of breaking in the motive mechanism of our cars, because no checking limits could be set to which the performance of every chassis could be standardized, due to the following deficiencies of the method:

First, in producing cars in quantities, it is impossible to send them all through the same channel; that is, they cannot all be tested by the same tester, and different testers' ideas of satisfactory performance are sometimes at great variance. Second, range of weather conditions. When the weather is good, adjustments are easily made; but, except in especially favored localities, the work which can be imposed upon the car will not be sufficiently severe, being apt to run to speed, which is not usually the best nor most essential feature. When the weather is bad the car can be sufficiently worked; but, offset against this, is the disadvantage and inconvenience under which the tester must work to make adjustments, making the temptation strong to skimp this detail, or resulting in the car being run back to the shop for the work to be done there, which is wasteful of time. One particularly heavy item of the expense attributable to road testing is cleaning for paint after test, especially in the muddy season.

Over an extended period of bad weather very indefinite assurance can be had as to uniformity in speed performance. We have attempted to equalize good and bad weather conditions by adding dead-weight load to the chasses; but this proved to be a wrong lead, as it was found that the performance with dead load was so dissimilar to that with live load, as not to be comparable.

There is a pronounced tendency, entirely unintentional, on the part of the road-testing department to lose sight of essential features of performance, due primarily to the fact that the first work of the department is expended in checking the work of the assembling section and making adjustments. The imperative demand is for sweet, smooth-running, flexible, quiet cars and, in nine cases out of ten, the testers handle the road work with this end in view and with performance as an incidental. As evidence of this, a regular blank road-inspection card is submitted on which, it will be noted, only the first item takes account of performance, and that very indefinitely; the balance of the items relate to purely structural conditions, the only value of the report as a record being to show who tested and inspected the car. The report of the tester on performance is a purely verbal one made to his foreman, in which he states that the car runs to his satisfaction, and seems to have sufficient power and speed.

Testing Machine Decided Upon

To combat this ambiguity, it was decided to devise some means by which performance could be mechanically checked and, this decision obviously pointing to some form of dynamometer with which road absorption of power could be approximated, the absorption brake shown in the accompanying drawings was designed. How well it accomplishes the desired result will be described.

Fig. 1 shows a chassis connected up to

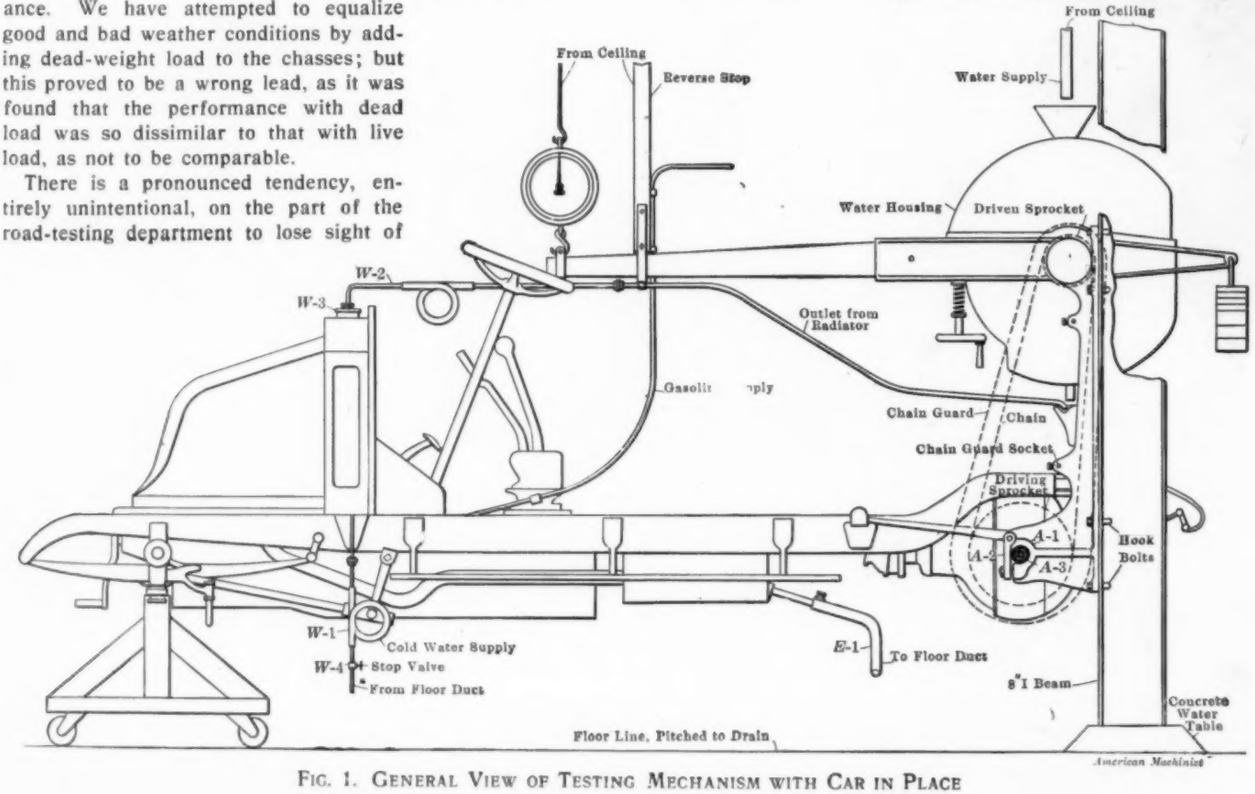


Fig. 1. General View of Testing Mechanism with Car in Place

the brake; Fig. 2, a front view; and Fig. 3, details of brake parts. The chassis comes directly from the assembly floor on the trucks on which it is assembled, one under each axle. It is well to note here that the assembly is carried much further toward completion than is usually the case, every part shown, with the exception of the hood and testing appliances, remaining permanently in place. Because of the pitch of the floor, the placing of the rear axle ends in the seats *A*1 enables the rear axle truck to be withdrawn, giving a clear space in the vicinity of the axle for making adjustments.

The test gasolene pipe siphons to the gasolene strainer and carbureter pipe of the chassis, from a tank outdoors at the same level as the tank in the finished car. This siphon arrangement avoids piping gasolene through the floor duct, a dangerous place, and at the same time avoids decreasing facility of passage about the machine.

Lessened cooling efficiency of the radiator, due to the power being developed with the chassis standing still, is compensated for by means of water pipes *W*1 and *W*2; pipe *W*1 furnishing cold water to the radiator through the usual drain-cock connection, and pipe *W*2 taking care of the overflow. Radiator cap *W*3 is part of the test outfit. Valve *W*4 controls the amount of water supplied, quantity required being indicated by condition of the outflow. We cool by thermal circulation and, in this case, just sufficient water is supplied so that the outlet does not blow steam. Note, also, that this arrangement insures an always full system and that, even with the additional supply, the system handles the water in a normal manner.

Exhaust pipe *E*1 is loose in the floor duct and runs outdoors with an open end. It is a slip fit on the muffler tail pipe and is held in place by the set screw shown.

Coupling the Car to be Tested

Fig. 2 shows the method by which the chassis is coupled to the brake. The rear axle is in its final assembled condition (including brake mechanism, although not shown in the figure), with the exception of wheels, wheel bearings, and hub caps. With the chassis still on the assembly trucks and in position just in front of the brake, the spools *A*3, Fig. 1, are slipped over the ends of the axle tubes, the rear end of the chassis is lifted and the spools set into seats *A*1, the clamps *A*2 being opened for the purpose. The spools govern the lateral, and the clamps, the longitudinal alinements of the chassis. No particular care need be taken of the setting of the front end of the chassis, as the front truck casters will allow it to find its own position as soon as power vibrations are set up. The spools serve as spacers for the annular bearing members of the driving sprocket assemblies, which latter are now mounted into place (this can be done with the sprockets hanging in the driving chains) and fastened by means of the regular wheel-bearing nuts *A*4.

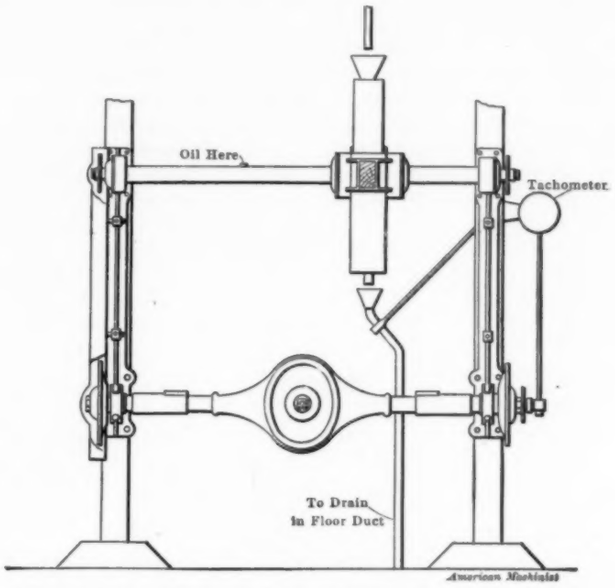


Fig. 2. Front View of Mechanism and Connections

The driving sprocket assembly is provided with jaw clutches the same as the regular wheel hubs, and accommodates stock hub-drivers which are held in place by hub caps, one of which is special in respect of carrying a speedometer gear. This speedometer gear meshes with a pinion which is part of a regular speedometer outfit, giving the same miles per hour reading as if the car was running on its wheels. The driven speedometer pinion is supported by a hinged arm (not shown) from the main post carrying the dynamometer, and swings back out of the way when not in use. The speedometer itself has some specially arranged divisions added to it which will be mentioned later.

The brake-shaft driven sprockets are a sliding fit on the square ends of the brake shaft, so that an odd-sized sprocket may be used to run the live axle shafts at differing speeds to work the differential. This odd sprocket and the equal-sized pair are made considerably smaller than the driving sprockets, so as to speed up the moving parts of the brake and bring down their size and weight. The chain guards are made of galvanized iron and are mounted and dismounted very easily by means of the supports and set screws shown in Fig. 2.

Construction of Brake Proper

The brake shaft proper is a large diameter, cold-drawn steel tube, to give adequate bridging effect for the weight of parts it carries. It is provided with inserted ends for the sprockets, these ends

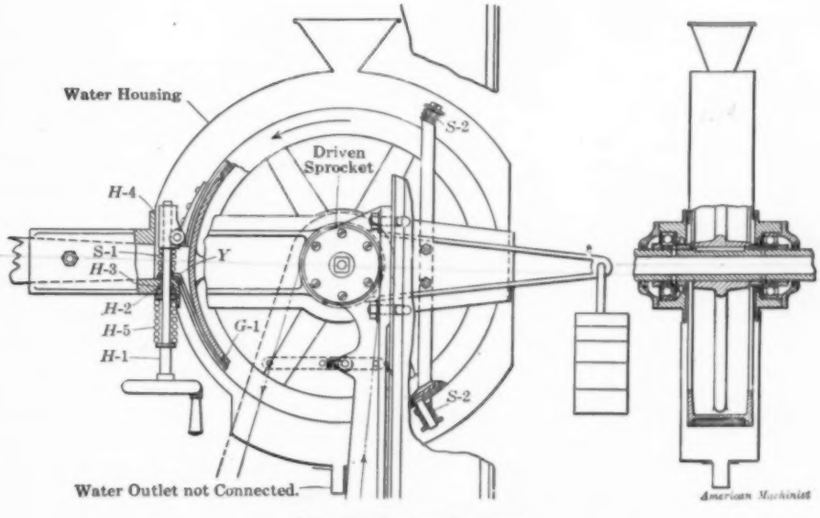


Fig. 3. Brake Details

being a heavy force fit, with shear pins to prevent the torque from turning them in their seats. The shaft is mounted upon annular ball bearings at the ends, by standard automobile construction methods and it, in turn, carries the brake wheel and two other annular bearings on which are mounted the brake arm. Provision is made for oiling all the bearings from inside the shaft.

The brake arm is of wood, fitting into a tapered socket in a cast-iron member which is carried on the last mentioned annular bearings. Integral with this casting, are flanges to which the housings for the cooling water are attached, and also an extension for carrying the arm-balancing weights. The brake wheel is of cast iron, feather-keyed to the shaft, and flanged to control the sidewise movement of the friction band. The wheel is located toward one end of the shaft, to bring it and the operating mechanism to the same side of the car as the control, for facility of handling by the tester.

The power-absorbing medium is composed of a brake-band arrangement almost identical with external wheel-brake construction, and of the same materials; i.e., asbestos composition riveted to a steel band. This band is anchored to the arm member at *Y*, Fig. 3, and is tightened or loosened by means of hand screw *H1* which bears on swivel seat *H2*. The latter also acts as a gland for packing *H3*, to prevent water leak at this point. The nut *H4* is swiveled to avoid cramping the steel band when the tension of the latter is altered.

Spring *H5* and grooves *G1* enable the machine to run continuously under any load, the grooves keeping the composition face lubricated, and the spring compensating for expansion due to frictional heating. Springs *S1* and *S2* serve to take the brake band out of contact with the wheel, and are useful mainly when the brake is calibrated.

A standard 100-pound spring balance is used, with large face and the divisions reading to ½ ounce. The hook is connected to the arm at 5 feet 3 inches from the brake shaft, this distance being selected to permit the use of the simple formula

$$\frac{PN}{1000} = H.P.;$$

in which P represents pounds pull, and N the number of revolutions of the brake shaft. A ¾-inch pipe supplies all the cooling water needed by the brake, and it is furnished in the manner shown, to avoid the influence of direct connections on the scale readings.

Calibration of the machine was very easily arranged for, by substituting a tube of the same diameter as the axle tubes and of proper length, in place of the axle; passing through this a single shaft having the proper squares, and an extension on one end smaller than the square, and direct connected through a hole in the hub cap to a small electric motor of known efficiency. The efficiency ratio was not a factor in the work for which the machine was intended, but was ascertained because of the portended usefulness of the machine as a dynamometer in engineering investigation.

Obtaining Standards for Tests

Having the machine capable of absorbing the power of the chassis, it was necessary to acquire data as to road performance of cars, that a standard might be set which chasses tested in the machine would have to meet. Accordingly, a completely equipped, finished car was selected which, it was agreed, represented the general run for performance. A gradometer which automatically registers, by means of a moving hand, the percentage of road grade, was specially designed by the writer and applied to the car. A speedometer was also part of the equipment.

MOTORS.
FINAL INSPECTION REPORT

MOTOR NO. 91 MODEL A July 5 1910

TESTED BY	TIME RUN HOURS	FINAL INSPECTION AFTER RUN: CYL. BORE	PISTONS	RINGS	CONNECTING RODS: UPPER	LOWER	EVIDENT RUNNING CONDITIONS: SMOOTHNESS	QUIETNESS: VALVES	GEARS	LEAKS: WATER	OIL	FLEXIBILITY
M FR	10	good	good	good	OK	OK	fair	quiet	fair	none	none	good

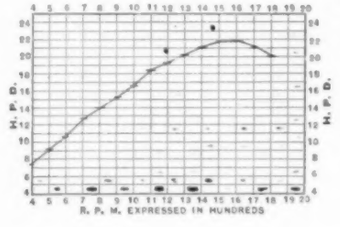
H. P. D. M. P. M.	LBS.
400	2 ?
500	2 ?
600	2 ?
700	2 ?
800	2 3
900	2 ?
1000	2 ?
1100	2 ?
1200	2 ?
1300	2 ?
1400	2 ?
1500	2 ?
1600	1 ?
1700	1 ?
1800	1 ?
1900	
2000	

LENGTH OF BRAKE ARM	CARBURETOR	IGNITION	MUFFLER
4 Ft.	Kingston	Volta	none

REMARKS

New style oil pump
Magneto with spark shield used for test
To be replaced with fixed spark
New oil baffle in crank case.

7/6/10 DATE PASSED H. C. Meyers INSPECTOR



American Machinist

Fig. 4. Final Inspection Report after Brake Tests

The car was thoroughly tuned up and the following tests for performance data were made with full passenger load, all the tests being made in dry weather, on macadam and dirt roads in first-class condition.

First, maximum sustained speed. This was a straightaway run on a dead level road, with throttle wide open and spark advanced to its best position, the speedometer only being necessary to get this information.

Second, maximum pulling, or tractive, power on high gear. The figure required here was the speed at which the car would negotiate a uniform grade of such percentage that, with wide open throttle and spark advanced to just back of the knocking point, there would be neither acceleration nor retardation in the car speed. On this test also, the speedometer reading made the required record, the function of the gradometer being to insure that the grade upon which the test was conducted was of uniform percentage. As a matter of interest, however, the gradometer reading was recorded for the purpose of later calculating the tractive effort of the car. Of course, the speed attained in this test was very much less than the speed on the level. The third and fourth tests were for pulling power on intermediate and low gears, and data were obtained in the same manner as in the second test.

With these data in hand, the car was returned to the shop, stripped to the required condition and hooked up to the dynamometer. The road data tests were then reproduced on it, its speedometer enabling the speed of the motive mechanism to be properly controlled, and the maximum obtainable pull on the scale at the data speeds giving the equivalent of the road performance.

These records were tabulated, a minimum limit was then set for each case, and these figures form the standard to which every chassis must attain before the inspection department will pass it.

Economic Results

This method of testing is very much cheaper than road testing for several reasons; first, one tester and a helper can take care of three brakes and do all the work of turning up the chassis; second, there is no fitting and dismounting of special testing bodies; third, no mud to clean off before painting; fourth, saving of tire wear.

Test Procedure

The general procedure of testing is as follows: When a chassis is first connected to the dynamometer, the odd size sprocket before mentioned is used for a preliminary run (each driven sprocket has a chain of its own, to avoid altering the lengths of the latter), during which adjustments are made all over the chassis

for proper running condition and quietness of operation. The last fifteen minutes of this run are made on reverse gear, for which the reverse stop shown in Fig. 1 is provided, the dynamometer being a one way machine only.

This being done, the differential sprocket (so called) is replaced by the mate to the other and the runs for power are started. In the order named, runs are made with gradually increasing load on low, intermediate and high gears, the final run in each series being with the maximum pull obtainable on that gear. If, at the finish of these runs the chassis is operating satisfactorily, as regards quietness and flexibility, four final checking runs are made for performance and, if these come within the required limits, record is made on the chassis inspection sheet, by the foreman of the testing department, and the chassis is turned directly into the paint shop. If the minimum for any one performance limit is not reached, the chassis is turned back to the assembling department.

Form 292

ROAD INSPECTION CARD

MODEL.....

Date.....

Car No.....*Motor No*.....*Transmission No*.....*Rear Axle No*.....

Road Inspector must see that Chassis Inspection card is attached to chassis and properly signed and dated. He will then sign his name to same and return to Inspection Room.

1. Try car on road for power and speed.
2. Timing gears must be free from noise.
3. Compression should be uniform in all cylinders.
4. Valve mechanism must be quiet and uniform.
5. No leaks in water jacket, manifolds or radiator.
6. No oil or grease leaks on motor.
7. Motor free from "knocks."
8. Remove bottom plates and look rods over carefully.
9. Oiler must feed properly and be quiet.
10. Timer quiet and properly set.
11. Magneto set correctly and properly wired.
12. Clutch must hold at all speeds and must not "grip" or "drag." No oil leak at clutch cover.
13. Pedal shafts must not vibrate.
14. Clutch shaft free, and coupling and brake disk tight on shaft.
15. Transmission quiet on all speeds; gears must shift easily and lock in each speed.
16. No grease leaks about transmission or universal joints.
17. Torque tube housing must work without lost motion.
18. Frame must be level both in front and rear (limit $\frac{1}{4}$").
19. Rear axle must be quiet.
20. Steering gear free from lost motion and front wheels set in $\frac{1}{4}$".
21. Remove transmission cover and see that all parts are in place and teeth in good condition.
22. Remove rear-axle cover and see that differential gears mesh properly without "excessive play." See that all bearings are tight and locked, and all nuts tight and well cottered.
23. See that clean oil is put into motor and grease into transmission and rear axle.
24. Go over car carefully and see that all parts are in place and properly fastened, all nuts tight and properly locked, shock absorbers in place and of correct length (7" front and 8$\frac{1}{2}$" rear). Inspector will check off all items, noting corrections on back of card, and check off same after corrections are made. He will then sign and date card and attach to frame.

NOTE—Car is not to leave Road Test unless Inspector's ticket is attached and signed by him.

BY ORDER OF FACTORY MANAGER.

ROAD TESTS NOT ABOLISHED ENTIRELY

About one car in ten is put on road test directly from the assembly floor, tested in the usual manner and, when being stripped for paint, connected to the dynamometer and proved up.

It is unquestionable that the cars must have some road work as, otherwise, some very vital points such as steering gears, brakes, etc., would fail of having proper adjustment because of not having been worked under load. This is accomplished after the cars are completely finished, by giving them a short road test over a selected route that assures of every not—heretofore—worked part performing its full duty. The route selected is one which, the year round, imposes very little extra cleaning on the cars.

THE CONVERTED TACHOMETER

In conclusion, this machine, quite inexpensive to build, and originally intended merely as an absorption brake for chasses, has, byseveral slight alterations, facilitated the means of acquiring many engineering data; for instance, five supplementary scales have been added to the speedometer, converting it into a tachometer. The first inside scale, added to the face of the instrument below the regular miles per hour scale, reads in revolutions per minute of the brake shaft and, with brake-arm scale readings, supplies directly read factors for calculating the horsepower at the brake arm. The latter, in combination with the efficiency factor of the dynamometer transmission mechanism, ascertained by the calibration beforementioned, gives the horsepower delivered at the live axle ends.

The second inside scale reads in revolutions per minute of rear wheels, and furnishes another directly read factor useful in determining the maximum tractive effort exerted at the periphery of the tire, for either high, intermediate or low gear.

The three outside scales indicate the revolutions per minute of the motor for each of the respective gears of the transmission and, by referring to the motor block test inspection sheet shown in Fig. 4, it is possible to work out the general, over-all efficiencies of the car.

We feel greatly pleased with the economy of this method of testing, as compared with the old way; but are much more satisfied with the greater positiveness of result, and the feeling of assurance that the performance of all cars is up to a definite standard.

A Three Cornered Scraper

BY C. N. HUBBARD

The three-cornered scraper is something for which every toolmaker has frequent use. It is so simple he hardly gives any thought to its construction, but more often than not, grinds the teeth from a worn-out three-cornered file, shortens it a little, shapes the point to such form as suits his need—or his fancy—provides it with some sort of a handle, and calls it "good enough."

There is one on the market now, which is essentially our old friend, nicely gotten up. It has a nurled handle of steel tubing, is light and good to look at. The defect of this construction is that it is difficult to get a firm and comfortable grasp on the tool close up to the point where it is most effective; three corners, all more or less sharp, do not furnish an ideal finger hold.

The way I overcome this difficulty may be of interest; it can hardly be beaten for simplicity. I use for the handle a piece of light brass tubing, four inches long and 7/16 inch in diameter.

The tool proper is made from a piece of a three-cornered file, 2½ inches long. I grind off the teeth, and grind away the corners so that it is a light driving fit inside the handle. I let the business end project about $\frac{5}{8}$ of an inch, and as it wears in sharpening, I rap it out a little. It answers the purpose very nicely, takes little time or trouble to make, and to my mind, is much more convenient than it is as usually made.

New England Foundrymen's Association

The fifteenth annual meeting of the association was held at the Exchange club, Boston, on Wednesday evening, Jan. 11, and proved a most successful and enjoyable occasion.

It was successful in point of attendance, for 182 members and guests sat down to the banquet. A visiting delegation from Philadelphia, led by the president of the Philadelphia association, Thomas Devlin, numbered thirty-two.

Among the invited speakers was Mayor Fitzgerald, of Boston, who, in addition to his address of welcome, sang a stanza of his favorite "Sweet Adelaide."

No professional papers were presented, as the annual meeting is the winter social gathering of the association. The officers for the ensuing year, elected at this meeting, are: Herbert E. Wetherbee, president; Charles L. Newcomb, vice-president; George H. Lincoln, treasurer; Fred. F. Stockwell, secretary.

Punches and Dies for Metal Buttons

By A. F. Horton

The different parts composing a metal cloak button and the tools for forming and assembling them.

Combination dies for blanking, drawing and embossing at one operation.

Very little has been written on the process of making buttons, and the tools used to manufacture them. The button selected for this article is an ordinary cloak button, as worn on ladies' cloaks, to be seen everywhere.

This button is made in five pieces, as shown by the accompanying halftone. *A* is the front plate, or face of button; *B* the inside, filling piece for face, this serving a double purpose, namely, to strengthen the face and as an ornament; *C* is the back plate of the button, which contains the eye by which it is attached to the cloak; *D* is the filling of cardboard that is placed between plate *B* and back *C* when assembled. This also serves a two-fold purpose; holding the plate *B* in place and filling space between it and the back plate, making a comparatively solid, but very light button. *E* shows the assembled button ready to be carded.

The material used varies in different buttons. The front plate of this particular one is of soft sheet brass, approximately 0.009 inch thick, and the inside filling piece is of cold-rolled steel, 0.010 inch thick, this being covered with a coating of lacquer. The back plate is made of the same material as the inside filling piece for the face. The eye is made of basic wire, 0.0625 inch in diameter, and the filling piece *D* is of cheap, compressed card board, 0.100 inch thick.

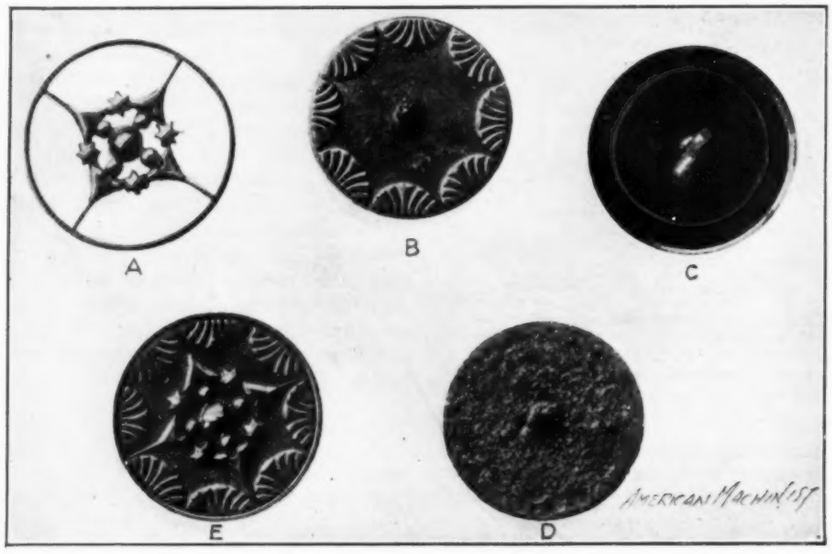


FIG. 1. PARTS OF A STAMPED METAL BUTTON

THE FRONT PLATE

Making metal buttons, in nearly all cases, is accomplished by a series of dies used on power presses and drop hammers. The tools for first operation on the front plate are shown in Fig. 2, and are triple-acting, including a die holder, containing two dies. Top die *A* is the cutting and drawing die, and the one at the bottom, *B*, is the embossing die, in which is engraved the top, or embossed part, of front plate. The cutting punch *C* is fitted to the cutting gate of the double-action press, and the drawing and embossing punch *D* is fitted to inside, or drawing plunger of the press.

Bottom part *E* is of tool steel, the end being embossed to fit die *B*. This is accomplished by first finishing the die as required and, after tempering, placing on bed of a foot-power drop hammer. The punch, having been heated in a furnace or forge, is driven into the die, until the full embossing is obtained. After it is cold, it is again struck in the die, lightly, to overcome the shrinkage. It is then relieved with a graver, fitted to the drawing punch and tempered.

The blank is cut and held in position by the cutting punch; the drawing punch then descends, drawing wall on blank, after which it continues descending, until the face of cup just drawn is struck in the embossing die with force enough to reproduce embossing in die on the face of the cup. The punch ascends and the cup is stripped from the punch by the bottom of the cutting die, and falls back on the face of the embossing die, from which it is removed by a jet of air, or the aid of gravity. These front plates usually are made from strip stock in coils, and fed to the die by a roll feed, enabling one boy to operate a number of presses, and by so doing, the cost of production on this operation is very low.

DOUBLE PIERCING

Tools to pierce the inside of the front plate are shown in Fig. 3, and are rather peculiar in design. In piercing the outside holes, or the four segments, the die serves as a punch, and the scrap remains in the work. This is accomplished by the spring pressure pad *F* bearing on the stock when the die is cutting. The inside, or small piercings around the stars in the center, are performed in the ordinary way, the scrap dropping through the die.

The top tool is constructed with an inside and outside punch, as shown in the drawing. The lower die is round and is fastened to die holder *G* by ring *H*. The holes for inside piercing are also shown in this drawing. Ring *I* serves a double purpose; the small diameter at the top is machined to fit inside of the front plate and, being notched, serves as a gage to place the front plate or die in proper position, also this ring strips the finished plate from the die. This operation completes the work on the front plate, preparatory to assembling.

INSIDE PLATE

Making of the inside filling piece will next be considered. The tools for the first operation are shown in Fig. 4, and are an ordinary, round blanking punch and die. The second and final operation on the filling piece is performed on an automatic drop hammer by the use of tolls shown in Fig. 5. The die *M* is made from a forging of composite steel, and on its top is embossed the required design. Force *N* is made by the process already described. These tools, besides embossing the face, form the outside edge, as shown at *B*, in halftone, Fig. 1. This work completes the inside filling piece ready to assemble.

BACK PLATE

Making the back plate *C*, Fig. 1, is performed by what is termed a combination punch and die; which makes the back plate complete in one operation, except the eye. The tools required for this work are shown in Fig. 6. The die *P* is made round, fitting in dieholder *Q*. The bottom part of the die is chambered out to fit head on drawing post *R*, which also serves as a die to pierce hole in back

plate for the eye. Ejector ring *S* is also machined with head to fit chambered-out part of die, the small part being the same length as cutting diameter of die. The ejector pins *T* force ejector ring to surface of die by rubber knockout placed on stud *U*, between washers. The punch is made in three parts; the cutting being performed by outside punch *V*; the inside, or piercing punch *W*, piercing the center hole for eye; the embossing ring *X* serving the double purpose of ejecting the back plate from large punch, also, when bottomed, embossing the bead which is shown in halftone.

Forming the Eye

The eye, being of wire, is made on an automatic wire-forming machine, with four sides. The device to do this work is diagrammatically shown in Fig. 7, and consists of three formers and a center pin. The wire is fed from coil by a grip feed, adjustable to any length. This wire is fed to back of pin, after which the back former *Y* is moved forward by a cam. At the instant the wire is gripped by this former, a cutter, also operated by cam, cuts the wire to desired length; the former continues to move forward and forms the wire around pin. A dwell on the cam retains it in this position, while the side formers *Z* move forward and form the eye as shown at *a*. The formers then release and the eye drops from pin, ready for another.

Assembling Eye and Back Plate

Tools to assemble the backplate and eye are shown in Fig. 8. The punch *b* is round, with the bottom end flat. The die *c* is made in one piece, and fitted to die holder of a small, quick-action bench press. The top part of die is made small enough in diameter to fit inside of bead in back-plate, the face is flattened on one side to within 1/16 inch of the center; through the remaining part, near the top surface, a pin is placed, the diameter being the same as inside diameter of eye. The hole is then counterbored 1/16 inch deep, the diameter being the same as the outside diameter of eye. The operator, while using these tools, has the back-plates in a receptacle on one side, and the eyes on the opposite; the eye is inserted in oblong hole in back-plate, after which it is placed upon pin *d*, Fig. 8, as shown. The punch descends and flattens the two ends, the force of blow being enough to fasten eye firmly in back-plate.

Cardboard filling *D*, shown in halftone, Fig. 1, requires only one operation. This is punched out by blanking tools, Fig. 4, which already have been described.

Final Assembling Dies

All parts for the button are now ready for final assembling. This work is performed by using the rolling tools, Fig. 9. The punch *e* is round, the bottom being chambered out the diameter of outside of front plate, and with round edges, as shown in drawing. A hole is drilled in center, large enough to allow the eye to pass up inside freely. Die *f*, Fig. 9, is made in two pieces; the bottom part of flat steel, machined to fit die-holder of small press; the top part being round, screwed into bottom plate, the top being chambered out to fit the outside diameter of front-plate.

To assemble the buttons, the various parts are placed in the most convenient position to assist the operator; the front plate is taken in one hand, face down; the inside, filling piece is next placed in position, also the cardboard filling; the back plate is then forced down inside of rim of front plate; the button is then placed face down on die *f*, Fig. 9, the punch descends and rolls edge of front plate over edge of back plate, pressing all parts until tightly compressed and locked together.

The button is now completed, ready for carding and, although this is only one style of many metal buttons, all are made in practically the same manner.

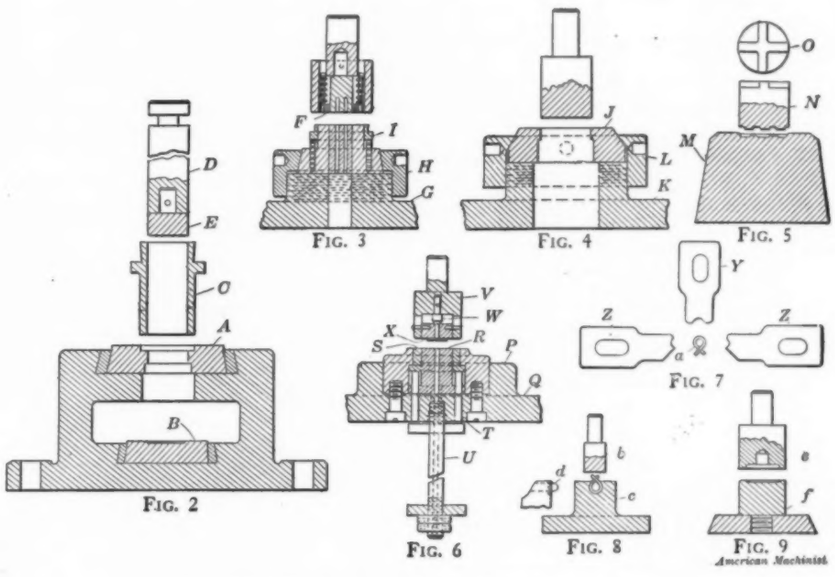


Fig. 2 Fig. 3 Fig. 4 Fig. 5 Fig. 6 Fig. 7 Fig. 8 Fig. 9

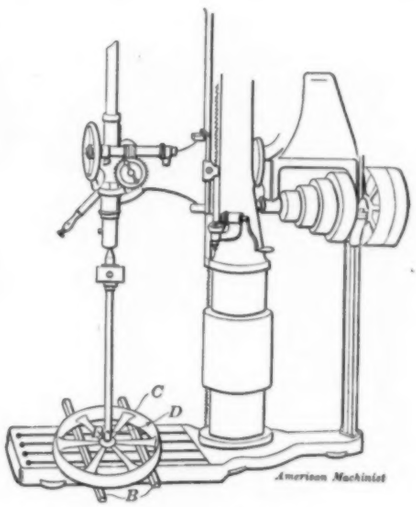
Punches and Dies for Making a Metal Button

Quick Method of Rebabbitting Pulleys

By John A. Luther

When bearings in pulleys become worn and need repairing, a quick way to rebabbitt them is shown in the accompanying illustration.

A round piece of metal that is the size of the hole wanted and has a square end is put in the drill-press chuck, as shown at *A*. Then a pair of parallels *B*, *B* are put on the plate of the drill press, and the pulley *C*, which is to be babbitted, is placed on top of these. The shaft is then run down through the hole in the hub until it is tight against the platen. A few asbestos-paper washers were previously put on the shaft close to the face of the hub, and an ordinary slip collar used to hold them in place, and prevent the metal from running through.



Babbitting Pulleys

The pulley is then centered by using the shaft *A* and the outside diameter of the pulley rim. This is easily done by calipering from points *DD*. There is no necessity of clamping down the pulley. The metal is poured into the top of the hub. If the shaft is oiled previous to pouring it will prevent the babbitt from sticking to the shaft. This rigging will be found very speedy and perfect running pulleys can be obtained if they are accurately calipered when centering.

Time Required to Hob Gears

By Walter G. Groocock

A table for spur gears, giving the time for $\frac{1}{10}$-inch of travel of the hob for various numbers of teeth in the gear and certain feed pulleys on the hobbing machine; also a chart for cutting time of worm wheels. The importance of the time required for the overrun of the hob is emphasized.

On page 621, Volume 33, Part 2, in an article on "Calculations for Hobbing Gears," there appeared another of the handy formulas which are so useful to those who are interested.

As the article points out, the hobbing of gears, in its present state, is sufficiently modern to call for any matter that throws light on the processes involved; consequently, such a collection of data as that contained in the article is of extreme value. Even although the data refer to one particular machine, they are available for machines of any make by a careful selection of the constant.

Having some five years back gone over the same ground, that is, got out tables and charts for showing the time required to cut gears on a specific machine, I was particularly interested in the formula given, inasmuch as it was practically the same as the one used by myself, but in a simpler form.

While the formula is a good one, the real trouble is finding the constants that will suit:

(1.) The machine in use.
(2.) The material used.
(3.) The pitch of the hob.
(4.) The cutting speed.
(5.) The desired finish.

My method of compiling a table may

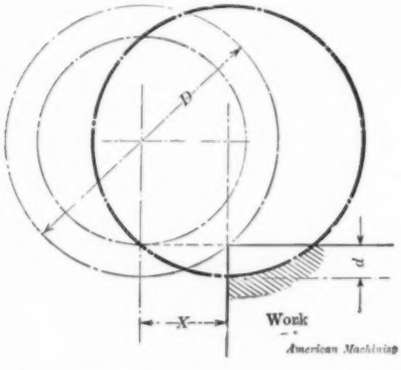


FIG. 1. DIAGRAM OF OVERRUN OF HOB

be of interest, and is given, together with Table 2, not because of its present value (for the data on page 621 are of more use), but because it may suggest similar tables to those interested.

It is a fact that the cutting time f any machine can be expressed by a formula, and in all hobbing machines the following formula holds:

$$Feed\ per\ minute = \frac{No.\ of\ revolutions \times constant}{No.\ of\ teeth \times depth}$$

The difficulty, as before stated, is the constant, which I had to deduce from practice. The constant should vary with each pitch, but as the change in the constant is small we can put several pitches into one group. In fact, for the particular machine in question, a No. 2 Reinecker universal gear cutter, it was found that two constants would cover the whole range between 6 and 26 pitch. But in our particular case, as we were doing small pitches on a large machine, the maximum number of revolutions of which was 100, the hobs for the small pitches were made larger than is usual in diameter and only one constant was used. This constant, divided by the depth (maximum of group), gave us a new constant and the formula became:

$$Feed\ per\ minute = \frac{No.\ of\ revolutions \times 0.04}{No.\ of\ teeth}$$

which, since for the group mentioned we had only 100 revolutions available, gave us

$$Feed\ per\ minute = \frac{4}{Number\ of\ teeth}$$

The hobs were single pitch, made of Armstrong Whitworth's high-speed steels, and the diameters are given in Table 2. The last formula given was used to plot a chart, and it was seen that, not having an infinite number of feeds, it resolved itself into a series of straight lines, each covering a certain range in the number of teeth, consequently this chart was not issued, but Table 2 was substituted for it. In this table, particulars are given as to the diameter of the hob, depth to be cut, feed to be used, and the time taken per 1/10 inch of hob travel. In another column will be found the allowance that must be made for the run in of the hob. For the purpose of close estimating it is necessary to know this extra travel, for when cutting gears singly this may amount to over 100 per cent. increase in the cutting time, and 50 per cent. increase is quite common. Fig. 1 shows what an amount this is for a typical hob, and incidentally shows one good reason for keeping the hob diameter small. In Fig. 1 the thin double circle shows the hob when starting into the work, the heavy circle giving the position when its center is in the plane of the work face. The amount to be added to the width of the work to get the total travel is denoted in the diagram by x, and this may be taken as

$$x = 1\sqrt{d(D-d)},$$

when D = Diameter of the hob; d = depth of the gear tooth.

Table 1 gives in round figures the

Diametral Pitch.	Allowance for Hob Entry on Hob Diameters. 2″	3″	4″	5″	6″
3			1.54	1.76	1.95
4			1.37	1.56	1.72
5			1.25	1.41	1.55
6			0.98	1.15	1.3
8		0.86	1.01	1.13	
10		0.78	0.91	1.02	
12		0.72	0.83	0.93	
14	0.54	0.67	0.77		
16	0.51	0.63	0.73		
20	0.46	0.56	0.65		

TABLE 1. HOB ENTRY AND OVERRUN.

Diametral Pitch.	Diameter of Hob.	Depth of Cut.	Extra Travel for Hob.
6	3.25″	0.36	1.03
8	3.25″	0.27	0.9
10	3.25″	0.216	0.81
12	3.25″	0.18	0.75
14	2.9″	0.154	0.7
16	2.9″	0.135	0.65
18	2.9″	0.12	0.6
20	2.9″	0.108	0.55
22	2.9″	0.098	0.53
24	2.9″	0.09	0.52
26	2.9″	0.083	0.5

No. of Teeth in Gear.	Feed Pulley.	Time per $\frac{1}{10}$″ of Hob Travel.
0 to 16	5 fast	0′-24″
17 to 25	6 fast	0′-38″
26 to 36	1 slow	0′-50″
36 to 55	2 slow	1′-20″
56 to 80	3 slow	2′- 0″
81 to 120	4 slow	3′- 0″
121 to 165	5 slow	4′-20″
166 to	6 slow	6′-54″

TABLE 2. FOR CALCULATING TIME TO HOB SPUR GEARS ON A NO. 2 REINECKER UNIVERSAL GEAR CUTTER.

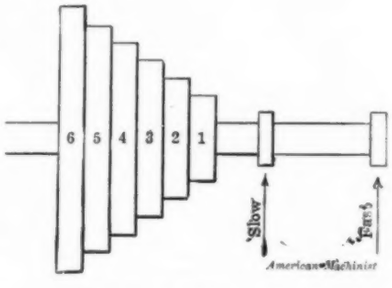


FIG. 2. PULLEY DIAGRAM

amount to be allowed for hobs of different pitch and diameters.

Referring again to Fig. 2, the skeleton-pulley diagram shows the position of the belt to get a given speed, and also the position of the moving spindle which is indicated in the fast and slow positions by the arrows. It was found that the hobs would get through any of the sizes quoted in much less time than given by the table, but it was not considered advisable to push the machine to the limit of the hobs on account of the corrugated appearance of the root of the teeth; also the finish of the tooth side suffers when the work is forced. Smaller hobs running at a greater number of revolutions would and do solve this question of feed marks on the bottom of the cut, but as before mentioned on this machine (which is capable of 48 inches diameter) the limit was 100 revolutions. A careful analysis of Table 2 will show the necessity for small machines, with their higher range of hob revolutions, when small gears have to be put through in any considerable quantities.

Time Required to Hob Worm Wheels

While on the question of hobbing, a chart for determining the time required to hob worm wheels may be in order. This was gotten out for the same machine, and is given because it is fairly general in its application. As is known, the Reinecker universal gear cutting machine uses, when hobbing worm wheels, a taper hob that is traversed tangentially under the work, a differential gear on the machine compensating for the altered position of the hob, which is thus kept in the same relative position with the wheel teeth.

The chart, Fig. 3, is plotted both for number of teeth in a one-inch pitch wheel, and for various diameters. The times are based on hobs of standard proportions, that is, four wheel pitches of taper and two pitches of parallel. An allowance of 1½ pitches is made for the run in of the hob. For the construction of the chart, the general formula for hobbing machines (mentioned before) was used, and the constant 0.05 was derived from practice. As the depth for standard gear teeth is 0.68 of the pitch, the formula for one-inch pitch reduces to:

$$\text{Feed per minute} = \frac{\text{No. of revolutions} \times 0.074}{\text{No. of teeth in gear}}$$

The logarithms of the feeds to a convenient scale were plotted vertically, and the logarithms of the number of teeth, also to a convenient scale, were plotted horizontally and then straight inclined lines were put on to represent each speed of the machine.

To Use the Chart

Required, the cutting time for hobbing a worm wheel having 100 teeth, pitch ½ inch.

Multiplying the number of teeth by the pitch gives us 50. Assume a small hob running at 100 revolutions per minute.

By following the vertical at 50 down until the line representing 100 revolutions is reached, read horizontally to the right for the feed and position of pulley, and to the left for the cutting time. Similarly, when the diameter is known, and speed from the size of hob is assumed, by running up the vertical representing the diameter until the speed line is met, read off as before both the cutting time and the feed to get it with.

For worm wheels of a common variety where finish need not be considered the next higher feed may be taken, and the corresponding time read off. The chart is for manganese-bronze wheels, and consequently for worm wheels of steel the next slower feed should be taken, this approximating to a constant of 0.04.

When the hob does not follow the length on which this chart is based a corresponding proportion of the time given must be taken. A feature to be noticed is that, whatever pitch a wheel is, for a given diameter and number of revolutions of the hob, the time is the same. This has been criticized by the unthinking, and probably will be again, but it is perfectly sound in practice. When procuring data for arriving at a constant, I cut some small worm wheels 45 teeth 2/10-inch pitch, and these were hobbed in three minutes, four minutes taking the hob quite clear of the work. The total time to put one of these wheels on, hob it, and take it off, was 10 minutes. Now this brings me to my last point. The fixing time was 150 per cent. of the cutting time, and although this is exceptional it shows that the cutting time given by a chart must not be considered as the total time. This can only be arrived at by the estimator after duly considering the number to do and the facilities available for rapidly changing the work.

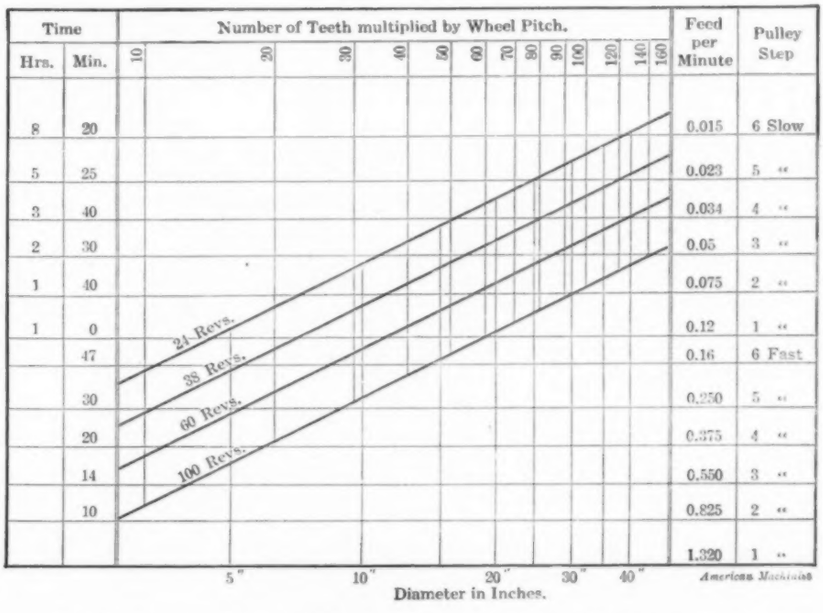


Fig. 3. Cutting Time for Worm Shells. Reinecker Universal No. 2

Index for Data Note Book

By L. H. Morgan Browne

My notebook is a Tangwell 6x9-inch loose-leaf book. I have been keeping a notebook since 1900, beginning with an ordinary bound book and making the entries in chronological order as the occasion arose.

About four years ago, the firm I was then with used the Tangwell loose-leaf books, and one Christmas made presents of notebooks to the draftsmen. Then began the work of sorting and copying my notes, which I did in this way: I took my old notebook and separated the leaves, spread them out on a table and sorted them into groups, using the index in "Unwin's Elements of Machine Design" as a guide.

As an example, consider a note on proportions of brass glands. I turn to the index in Unwin's and I see glands, page 161; then I turn to the contents at the beginning of Unwin's and find that page 161 is in Chapter VII. My notebook I divided into chapters by writing Chap. 1, etc., at the tops of pages at intervals throughout the book, and any note I have to file is filed according to the grouping of the contents in Unwin's.

Until a notebook gets very large, an index is not necessary to find things; but it is most indispensable as a guide for filing so that the data are filed systematically, which systematizing renders a subsequent search so easy that I seldom have to use the index to find things in my notebook, although I always do on filing fresh data.

Cutting a 24-foot Flywheel Gear

The accompanying halftone illustrations, Figs. 1 and 2, show the set up for cutting a 24-foot combination gear and flywheel at the works of the Mesta Machine Company, Pittsburg, Penn. This gear is to be part of a rolling-mill drive, direct driven by a 3000-horsepower electric motor, at a normal speed of 92 revolutions per minute. The gear, or teeth cut on the periphery of the wheel, form part of a barring device to start the train of rolls from a position of rest. By means of a sliding pinion a small motor starts and drives this flywheel up to a speed of three revolutions per minute. From that speed the regular motor for the roll-train picks up the load and brings it up to normal speed.

The dimensions of the flywheel and gear are as follows: Pitch diameter, 24 feet 2.64 inches; face of teeth, 8 inches; face of wheel, 18 inches. The wheel is built up of eight sections, using the regular construction of the Mesta Company. The bore is 29 inches, the hub length 33 inches, and the weight of the finished wheel 100,000 pounds. The gear has 224 teeth, 4.076 circular pitch, 14½ degrees involute type, with an addendum of 1.059, and a dedendum 1.263 inches.

In addition to the fact that it is a flywheel for a direct-driven rolling-mill train, the wheel is noteworthy because made of cast steel.

Fig. 1 shows the set up for planing the teeth. The wheel itself was slung into a wheel pit, ordinarily used for turning large flywheels and the like, and the spur gear cutting rail of a large Gleason gear-planing machine was placed in position to plane the teeth. Fig. 2 shows the indexing mechanism, also from the Gleason gear planer, fastened in position on one end of the shaft upon which the flywheel was mounted in the wheel fit. These photographs are so plain that no explanation is needed.

A Savings-Bank Plan

By W. H. Sirius

Any plan that will induce a wage-earner to make an effort to save a portion of his earnings against the days of adversity is worth consideration by those who have seen streams of hard-earned nickels and dimes flow down the valley of waste and have also seen the suffering due to such improvidence. Men, and women too, earning good wages are thriftless, living up to the last dollar of their income and often a week or two ahead of it and finding more pleasure in the modern luxuries than satisfaction in the necessities of good living. Every man who earns his bread by his own efforts is entitled to the best butter he can buy and the best and happiest home he can live in and enjoy; but when these things cost all he earns they cost too much and the man is robbing his future welfare and that of his family by living on a false plane that makes no provision for the days of age and perhaps years of incapacity.

A year ago the employees of the American Can Company at the Maywood, Ill., factory organized an employee's bank. The bank was purposed entirely as a savings plan whereby all those who desired to make an effort to save a small amount each payday would be given the opportunity and also be protected from their natural tendency to spend the savings about as fast as they accumulated.

Shares were offered to those wishing to subscribe, at 25c. per share per pay-period (bi-monthly); the bank to run for 10 months, which made a paid-up value of $5 per share; 10 shares being the in-

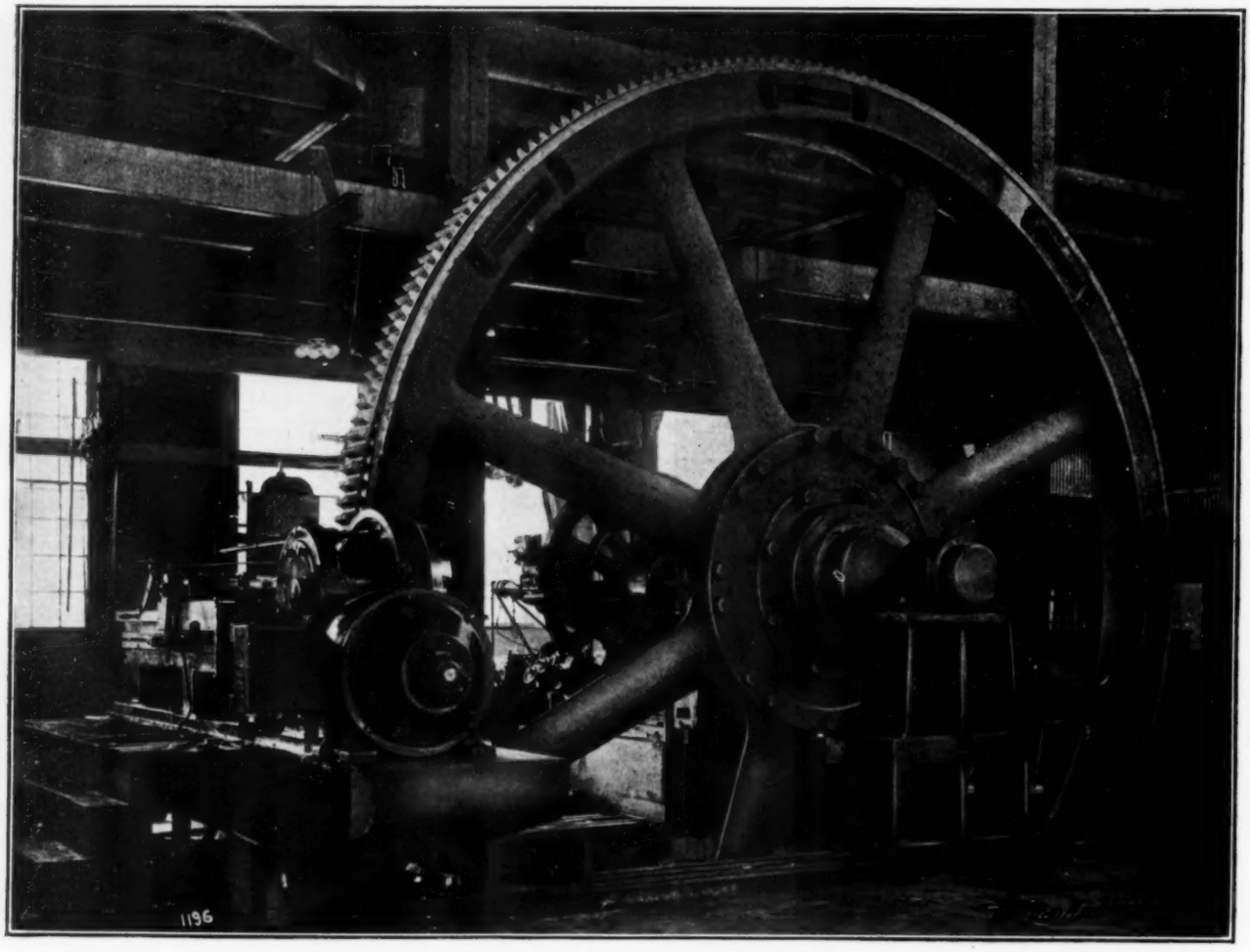


Fig. 1. Set Up to Cut a 24-foot Flywheel Gear

terest-bearing limit to any one person, though non-profit sharing amounts could be deposited by employees wishing to save more. Subscribers were allowed to borrow from the bank any amount up to 90 per cent. of what they had paid in at the rate of 2 per cent. per month or could withdraw entirely on 10 days' notice, relinquishing all claims to interest or profit on the shares withdrawn; fines were assessed for failure to make the periodical payment on the shares subscribed for within two days when payment was due. Shares did not bear interest or profit unless payments were regularly made during the 10 months' life of the bank and all surplus funds, over a certain amount of cash in hand for loans, was deposited with a commercial bank to draw a small interest. Thus there are several sources of income to act as inducements over the usual two or three per cent given by the commercial banks.

The profit of the plan depends principally on the weaknesses of the subscribers, the fines assessed for non-payment on shares being about equal to the amount of interest received from the commercial bank and the profit on loans to subscribers who need spending money frequently, amounts to about five times that amount. Also about 30 per cent. of those enrolling fall by the wayside or withdraw before the shares are fully paid for, all of which is grist in the mill of those who live up to their resolutions and save their money. This year the profits on the savings amounted to a fraction over 9 per cent. which made it a mighty good investment as well as an inducement to the improvident to get in on the melon. Those who wanted to save found it much easier than having the wife take it to the bank the "next" day or hiding it in the pantry, to be found the first time a shortage impended. Some went in for profit entirely, while others saved to meet insurance and mortgage payments.

There seems to be no reason why such banks should not be established in any shop or factory where there are enough employees to maintain it. Seven hundred employees of the *Chicago Tribune* saved $50,000 and netted 10 per cent. on the savings by a similar bank. In all the many places I have been there were men who saved, some who tried to save and some who begged carfare and borrowed rent money a few days after payday, at high rates of interest to the "Shylock" who would take the risk. The firm has nothing to do with the bank except to favor it tacitly and perhaps allow a clerk to collect the payments on payday and bank the funds. Officials can enter the plan under the rules that apply to all and all moneys are handled and loans made by a finance committee elected by the subscribers.

I do not know the origin of this plan; it is not original with us. It has benefited a number who did not save before and is a source of profit to those who do save. We expect to double our investment this year by increasing the price of shares to 50c. each and expect to double the number of subscribers, due to the good showing of last year.

The growth of the vacuum cleaner industry is indicated by the standard fitting sheets which are being issued by the Keller Manufacturing Company of Philadelphia. The latest shows the Standard Long Turn Flush Inside Drainage Fittings which should be used in vacuum cleaner installations in order to provide as little resistance to the air and the accumulated dust as possible. These may be had on application.

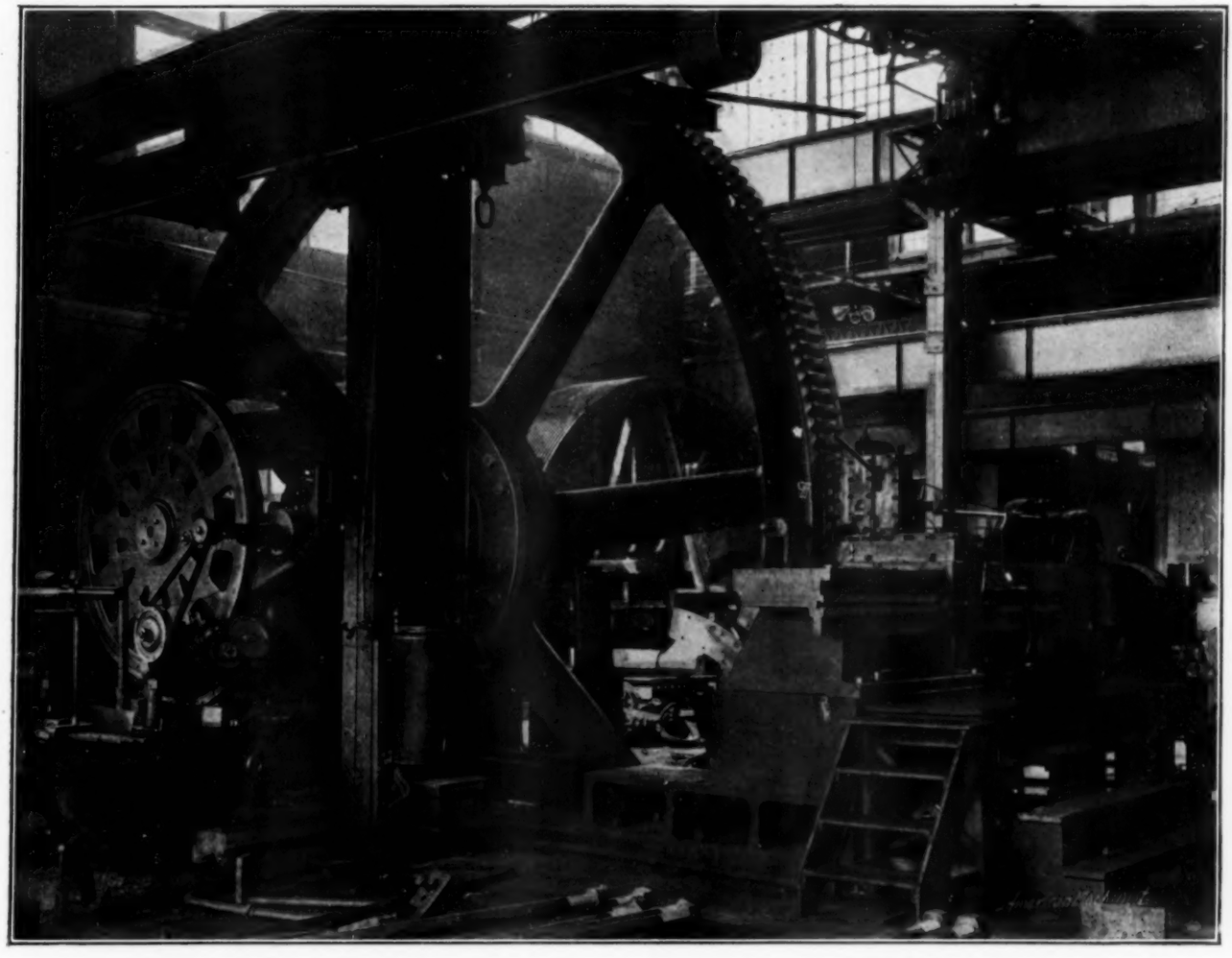


FIG. 2. ANOTHER VIEW OF FLYWHEEL GEAR, SHOWING INDEXING DEVICE USED WHEN CUTTING TEETH

Unusual Boring Machine Work

Editorial Correspondence

An interesting job in which a horizontal boring machine is used as a cold saw and for turning large trunnions on a cast steel riveter frame.

The illustrations show an extremely interesting application of the Lucas horizontal boring machine in the manufacture of a frame for a portable riveter. The frame is a heavy steel casting, and, after the hole is bored for the ram, it is clamped in the position shown in Fig. 1, while the extra length on the end of the trunnion is cut off by a saw or slitting cutter driven by the boring bar of the machine.

The next operation is the turning of this trunnion by the large hollow mill shown in position in Fig. 2. This finishes the trunnion to the size and shape indicated by the one on the other side, which has been already turned.

Operations of this kind give a very good idea of the wide range of work which can be done on machines of this type.

While this method would not be advocated if these were made in large numbers, there are many cases where it is essential to have a type of machine which can be used to advantage on a large variety of work.

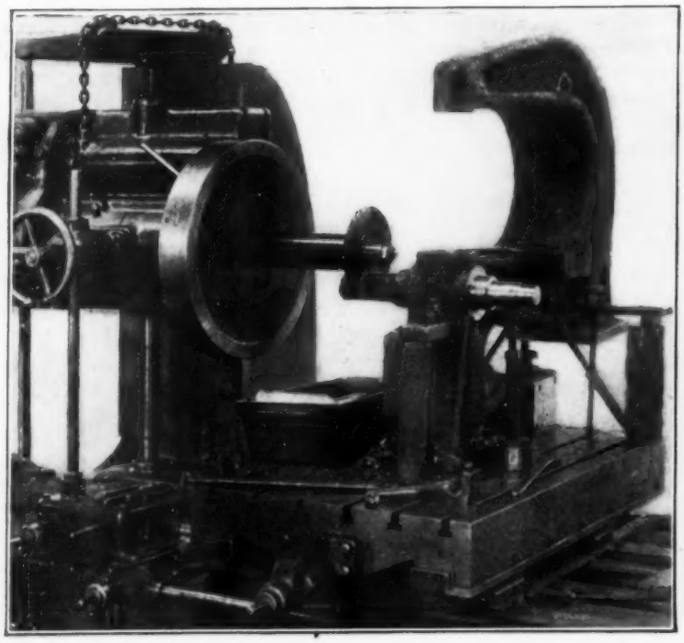


FIG. 1. SAWING END OF RIVETER FRAME

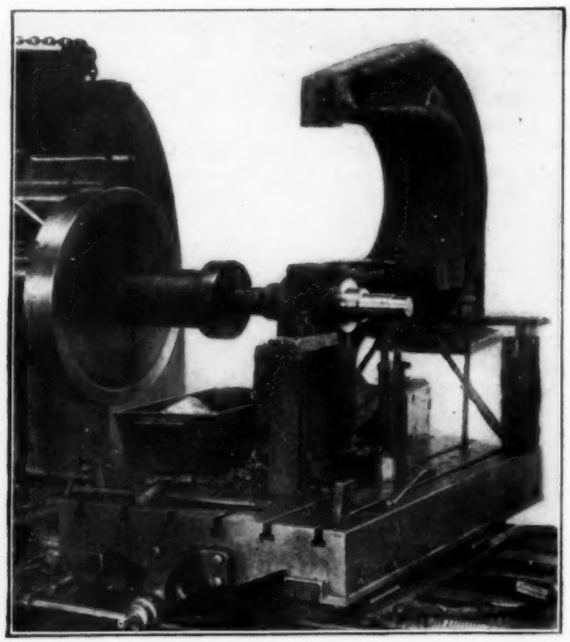
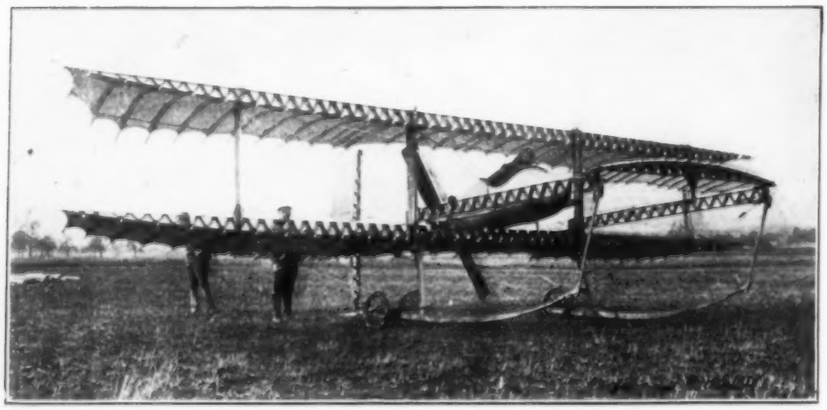


FIG. 2. TURNING TRUNNION WITH HOLLOW MILL

An Aeroplane with Tetrahedral Cells

The accompanying illustration shows an aëroplane recently constructed for the French aviator Paulhan. It is a biplane with the elevating plane in front and steering rudder in the rear.

The striking feature in its design is the use of tetrahedral cells. A series of these cells is placed along the upper edge of each of the main planes at their front, along the front edge of the elevating plane, vertically along the front edge of the steering rudder and in two long bands between the front edge of the lower main plane and the front of the elevating plane. These are for the purpose of steadying the action of the machine, being due to the kite experiments of Dr. Alexander Graham Bell with which much success has been gained.



AEROPLANE CONSTRUCTED ON THE PRINCIPLE OF TETRAHEDRAL CELLS FOR THE FRENCH AVIATOR PAULHAN

The construction is such that considerable rigidity is given to the fronts of the main planes, indicated by the absence of struts at their extreme ends.

An interesting feature is the torpedo-shaped shell within which the aviator sits, and is protected to a large extent from the cold air of high altitudes or winter weather.

At the aëronautical exhibition held in Paris in October, this type of machine formed one of the most interesting exhibits and received favorable attention by a number of aviation experts.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room. A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

Boring a Cylinder and Turning a Cylinder Head on the Same Lathe Simultaneously

The accompanying photographs show a cylinder 33 inches outside diameter being rebored and the cylinder head for same being turned at the same time on a 24-inch American lathe. The cylinder is the low-pressure cylinder of a Bury air compressor.

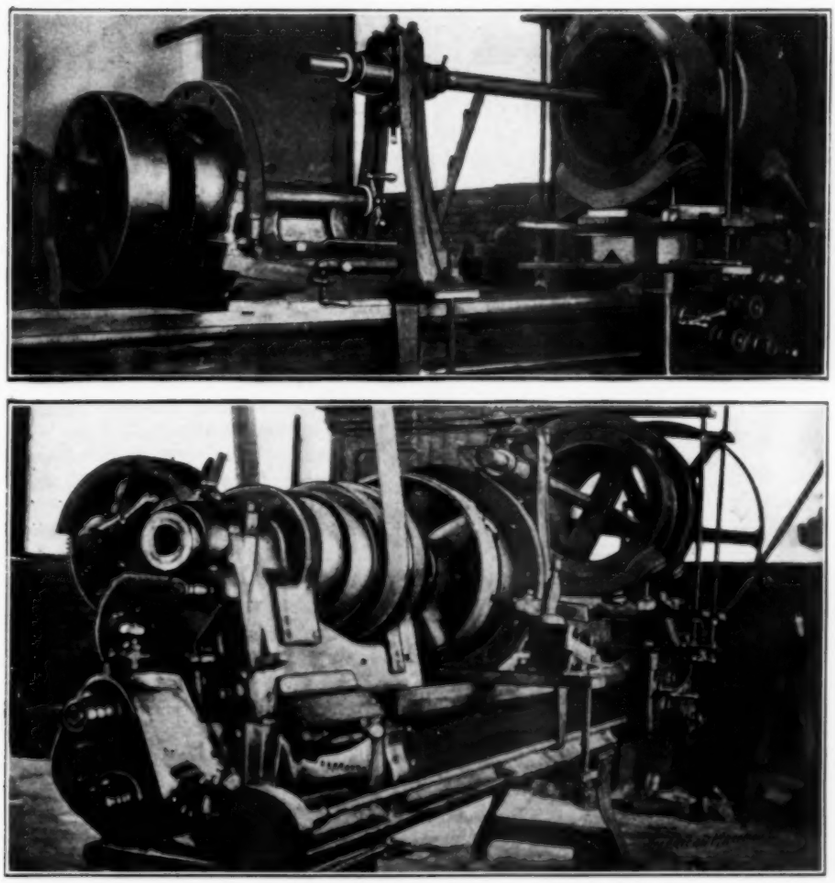
After stripping the lathe carriage I bolted two 1x6-inch iron plates to the lathe carriage, using four ¾x3-inch bolts on each plate. Two more 1x6-inch plates I put under the cylinder with these, and with the aid of 1-inch bolts with long threads I raised or lowered the cylinder as required. Two more 1x6-inch plates I used to clamp the cylinder when properly centered. For a boring bar I used a 2 7/16-inch shaft 10 feet long, shrinking a piece of 4x4-inch steel 18 inches long on it after putting a ½-inch square hole in each end for holding the cutting tools. I had three 2 7/16x30-inch shafting hangers which I clamped to the lathe bed to carry the boring bar, one hanger at one end of the boring bar and two at the other end, one on each side of a 45-inch pulley.

As the speed of the line shafting is 100 revolutions per minute I ran my belt from the line shaft to pulley, first wrapping the shaft with adhesive tape to prevent the belt from slipping. By this means the line shaft turned the boring bar and, starting the lathe, I could feed the carriage back and forth. This left the lathe chuck turning idle and as the counterbore of the cylinder had to be rebored, that meant the boss on the cylinder head to be turned in order to put a band around it. There is a clearance hole in the cylinder head for the piston-rod nut. I drove a mandrel in this hole and in this way held the cylinder head, using the tailstock as shown.

A full-swing rest comes with this lathe and, clamping this to the lathe bed, I turned ⅛ inch off the cylinder head while boring cylinder, doing the two jobs on one lathe at one and the same time.

Doing this job in this way meant a saving of time and money for the firm and I had the unusual honor of being complimented by the master mechanic.

Baton Rouge, La. FRANK BELLOWS.



DOING TWO JOBS ON THE ONE LATHE AT THE SAME TIME

Indexing Books of Reference

To make a list of topics on the fly leaf of the book to which one has to refer, is most useful. To explain, I turn to the fly leaf of my Kent and copy some entries I have made:

Teeth	889	
H.P. shafting	869	
Square roots	86	
Decimals	3	
Propellers	1010	
Equation of pipes	491	
Crane struts	441	
Circles	109	103

I take my Cambria Steel handbook and on the back cover I find I have made the following entries:

Length of rivets	335
Weight of rivets	322
Weight of nuts	324
Weight of square and round bars	383
Weight of flat bars	401
Weight of steel angles	34

Such a list as this, that one has made one's self, is searched at a glance and, being on the cover, is found at a turn of the thumb. All my books I treat the same way, the entries being made as soon as I have found what I have been looking for in the book at that time. It takes but a moment and saves minutes afterward.

Mexico City, Mex. L. H. M. BROWNE.

[Another, handier way is to cut semicircular notches through about ¼ inch of pages at the edges, writing the subject referred to on the portion of the proper page visible at the bottom of the notch, similar to a dictionary. No tapering of the notch is necessary and the work may be done with a carpenter's inside ground gouge, a hammer and a block of wood.—ED.]

An Industrial Railway Turntable

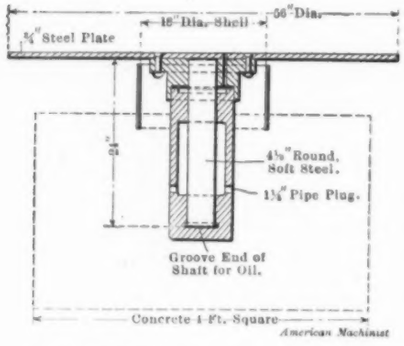
Fig. 1 shows the design of a turntable which has been used in connection with a 24-inch gage industrial railway about two years with no cost for maintenance except oil. The cars have a 34-inch wheel base, and carry a load up to four tons; this being the load the table was designed for.

The design is very simple, only two points requiring any calculation; these are the thickness of table and diameter of shaft. A boiler head 56 inches in diameter is used for the table. The worst condition is when a car is coming on or leaving. The moment about a line passing through the center, in the plane of the table and perpendicular to the track is

$$4000 \times 23 = 92{,}000 \text{ inch-pounds.}$$

A head ¼ inch thick, 56 inches diameter, gives a resisting moment, when the extreme fiber stress is 18,000 pounds, of

$$\frac{18{,}000 \times 56 \times 0.75^2}{6} = \textit{inch pounds nearly.}$$



AN INDUSTRIAL RAILWAY TURNTABLE

For the shaft, the resisting moment of a 4-inch round at 15,000 pounds extreme fiber is $15{,}000 \times 0.098 \times 43 = 93{,}000$ inch-pounds, nearly.

The head is fastened to the hub with twelve ¾-inch rivets. The 18-inch diameter shell is inserted to prevent dirt from getting in the bearing, also the hub sleeve projects over the box for the same purpose. The box is oil tight, hence, the table works in a bath of oil.

The method employed to set tables was to put in the concrete slab 10 inches thick, with eight ⅝-inch rods imbedded 8 inches and projecting 10 inches. This slab was allowed to set, then the box was set on it at the proper elevation and plumbed. The balance of concrete was then placed and the 18-inch shell located. When concrete had set sufficiently the box was cleaned of all dirt, a couple of quarts of heavy oil poured in and the shaft and table set in place.

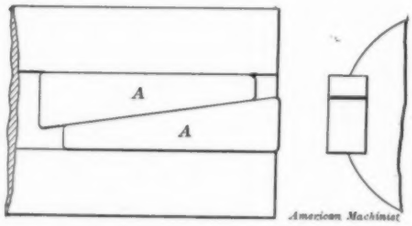
In the track, a tie was placed about two feet from the table; this allows the rail, which has the base and web cut back about 6 inches from end and the thread flared outward, to spring down and rest on the table when car is coming on or leaving, the car running on the wheel flange across the table. It is a good plan to have short pieces of rails next to the table, for the flared ends break off occasionally and have to be replaced.

These tables turn so easily that one man with one hand can turn the full load. They can also be made to spin with the foot. The cost of four tables, including pattern work and setting, was about $40 each.

Bradford, Penn. JAMES CLARK.

Keyway Guides for Shafts and Couplings

I inclose rough sketch of the method we use for keeping the keyways in alinement when putting couplings and wheels



KEYWAY GUIDES FOR LARGE SHAFTS

in position on shafts. It saves time and trouble especially when dealing with large sizes, either shrunk or press fits.

The cut needs very little explanation. The guides *A* can be made to suit the work generally dealt with and should be of tool steel hardened, one pair of guides covering a variation of about one inch in width. Care must be taken to have them clear of the top of keyways to allow of easy removal when work is in position.

Belfast, Ireland. TERRY.

Hardening Narrow Strips of Sheet Steel

A method that I used to prevent warping when hardening narrow strips of

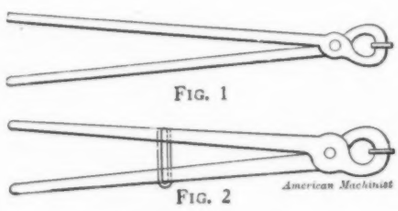


FIG. 1

FIG. 2

QUENCHING TONGS

sheet steel may be of help to some who are having trouble with similar work.

The pieces were ¾ inch wide, 3/32 inch thick and 4 inches long and had always warped badly when hardened in the usual way.

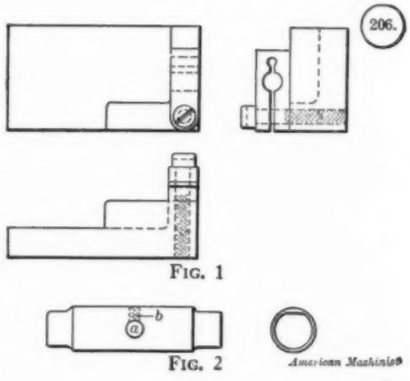
To overcome this I used a pair of ordinary tongs and heated them in an open fire to the proper temperature. I then quickly transferred them to a pair of cold cast-iron tongs, 4 inches wide, as shown in Fig. 1, the tongs being the same width as the pieces were long. After quenching the pieces with these tongs we found them straight and hard throughout.

If, as is often the case, it were desirable to have the center of the pieces soft and one or both edges hard they should be held in tongs made heavier, as shown in Fig. 2. When heated directly in these clamping tongs, the heat in the tongs will prevent the center of the piece from cooling as rapidly as the edges and hence it will remain soft.

Bridgeport, Conn. E. L. F.

Holders for Diamond Tools

In the small shop, having only one or two machines of a kind, much thought has to be given to the problem of adapting small tools to use on a variety of machines.



HOLDERS FOR DIAMOND TOOLS

In the operation of a No. 13 Brown & Sharpe universal grinding machine, it was found desirable to adapt the diamond turning tool for use when grinding surface work as well as when grinding cylindrical work, and in Fig. 1 is shown the device adopted to hold the diamond tool, being adapted for use on both classes of work, as is seen from the cut.

In Fig. 2 is shown a holder for use between the centers of the bench lathe. In use the diamond tool is placed in the hole *a*, and held by screw *b*, a dog being placed on the end of the holder and when the point of the tool is at the center, the wheel is brought up and trued up with very light cuts. By the use of the compound rest, wheels can be trued off at angles desired, doing away with all guess work. F. C. SCRIBNER.

Greenfield, Mass.

Broaches and Broaching

When I saw the article on "Methods Used in Babbitting Bearings," by George Hey, in Volume 33, Part 1, page 99, I really was glad to see some progress being made in the way of finishing babbitted bearings. I described a similar method in the AMERICAN MACHINIST 13 years ago; to be exact, in the number of June 24, 1897.

I was also pleased to see the accounts of broaching in your "Editorial Correspondence," as well as by C. B. Auel, in Volume 33, Part 2, pages 688 and 855.

In 1897, when I developed the broaches which were the subject of that article, I had a number of gears to babbitt and finish, the dimensions of the bearings being about 2 inches diameter by 6 inches or 6½ inches long. The gears in that case were webbed and presented somewhat different conditions from those mentioned in your articles.

BROACHING COMPARED WITH MILLING

There is a certain brush holder, part of which is shown in Fig. 1, to be machined where marked *f*. At the point *A* they are relieved to avoid so much machining. These castings were charged with molding sand and, because they were milled by means of homemade form cutters, this very sand acted like a grindstone. The brush holders were made of a hard brass, and the cutters never earned their own cost, which was $9 apiece. Annealing, resharpening and hardening them added another $3 to their cost, while a repeated annealing and hardening rendered them useless, as they cracked. The cost in wages for milling 100 brush holders was $1.25.

The work was shifted to another department where presses were available. Broaches were so designed that the cutters proper were held in a suitable holder, capable of being adjusted to compensate for wear; this broach holder was properly guided in a chuck which could very quickly be manipulated in gripping two brush holders, and releasing them, the cost of finishing the brush holders was reduced to 15 cents per hundred.

There is no doubt but that many operations, such as milling, boring and planing, now performed at high cost, could be better and cheaper performed by broaching. The character of the finish by broaching is every bit equal, if not superior, to that produced by other means, in fact, the finish of the bearings in the gears described fairly rivaled the inner finish of rifles and guns. Further, I would mention the finished surfaces in air-brake equipment, thousands of which are being broached, to a finish such that the corresponding pistons work air tight.

DESIGN OF BROACHES

Speaking now of the different broaches illustrated in your articles mentioned above, it seems to me that they could be improved by providing only one or two cutting edges, especially those used for closed holes, as in bearings. Two cutting edges should be used so that the first, or lower one, could be broken, as shown in Fig. 2. Each cutter should be of the same size. The breaking up of the cutting edge is for the purpose of severing the chip into parts, which is quite an item in the case of babbitt or other soft homogeneous metals. Then would I do away with the back relief, as it does not aid in cutting. The teeth can be easily sharpened by simply grinding their faces. That the necessity of grinding them is remote may be taken from the fact that the broaches I made in 1897 were of crucible steel; they held their size as well as

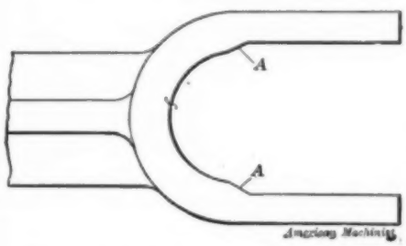


FIG. 1. A BROACHED BRUSH HOLDER

FIG. 2. DESIGN OF A BROACH AND EXPANDER

edges, in fact, we had no occasion to sharpen them at all.

COMPRESSING BABBITT IN BEARINGS

Speaking of compressing the babbitt in thin or even split bearings, especially when they are finished, or can be finished, on the outside, it seems to me there is no difficulty. My first step would be to finish them outside, insert them, after babbitting, into split bushings, tapered on the outside, insert these into a good and heavy ring, all things so designed that when pressure is exerted upon the broach the rings will have a tendency to still further compress the split bearings. Since some fixtures are made, or must be made, for alining the bearings while babbitting, the babbitt will be in the right place and have the correct size. This, then, will give good working conditions, such that the babbitt in the bearings will give a good guide to the pilot of the broach. This pilot must be amply long, 2 diameters I consider good.

Beyond this pilot should be placed an expander about 1/128 to the inch larger than the pilot, also about two diameters long, after which the relief for chips should follow; it should be long rather than deep. Immediately thereafter follow the cutting edges extended back, cylindrically almost as long as two diameters; the cut need not be more than 0.0025 inch deep or 0.005 inch larger than the expander. A smaller shank, the length of the bearing or a little longer, will finish the broach.

The gears mentioned above were heated to about 300 degrees Fahrenheit before babbitting, so as to expand them as much as possible, and, on cooling contracted, thereby hugging the babbitt more than they otherwise would. The force necessary to broach those gears varied from 12 to 15 tons, but the time to do the work was but a minute. Consider how long it would have taken to chuck a single gear in a lathe, bore and ream it, also the number of times it would be calipered! I also found that the metal would flow back, as Mr. Auel says it does.

The broaching machines mentioned by Mr. Auel bear out my statements insofar as long guides are concerned, also in the amount of cut, for while each tooth cuts more than 0.0025 inch they are very narrow, and the great number of teeth or cutters is only because, comparatively, a keyway is very deep.

Now, finally, about broaching, what would you call this operation? Is it filing, or planing, or punching?

Pittsburg, Penn. E. LAWRENZ.

Coloring Jig Bushings and Drill Chucks to Prevent Mistakes

Being only a young man in charge of a small shop employing 54 men, I look forward to the AMERICAN MACHINIST for information and new ideas. Each week I find something new and of interest.

The following is new to me and works out fine. Recently when I gave out a job for drilling a casting having some 20 or more holes (seven or eight different sizes) I found that some of the men would get careless and not read the figures on the drill correctly, hence redrilling was necessary. To make it easier for the men and stop this redrilling, I got some colored chalk and had the men draw a ring around the bushings with the colored chalk as follows: No. 32 bushings, all red; No. 31 bushings, all green; No. 28 bushings, all blue; and so on. The chucks are also marked: The chuck holding No. 32 drill, red; the chuck holding No. 31 drill, green; and so on down the line. It helped a whole lot and the holes came right and fast enough.

JOSEPH J. A. MANCEL.

Chicago, Ill.

An Etching Point

For etching, a pleasant freedom of action is obtained from the use of the ordinary pen. It has the advantage of producing a double line when desired, it enables the operator to elaborate as seems desirable. A first-rate single point is obtained by simply breaking away one of the points of a pen, the remaining point being most adaptable for fine work. The wax laid on the metal should not be too thin, as this lessens the advantage of proper examination of the work done before applying the acid.

ANDREW WEBSTER.

Glasgow, Scotland.

Assembling Tool for Typewriter Ribbon Spool

The tool shown in the illustration, Fig. 1, is for assembling the three blanks shown separately, and as ready for assembling, in Fig. 2. The assembled parts constitute the ribbon spool on one of the well known typewriters.

The blanks to be assembled are slipped over the post *A*. When the press is tripped, the downward motion is arrested by the cam plates *C* bearing against the work pieces *D*, and the cam plates force the fingers *E* over against the ears *F*, causing the latter to flatten and lie in the groove *G*. The right-hand sectional view shows the appearance of the tool and work at the end of the down stroke.

On the up stroke of the press, the cam plates *C* are returned to normal position by a coiled spring not shown and the fingers *E* are returned by the flat springs *I*. *J* is the carrier for the fingers, to which the latter are attached by pins.

Pieces *J* are not fastened permanently to the base and plunger castings. They are a snug fit in the latter and are fastened only by a set screw. This allows of easy removal in case of breakage. This tool is used in a foot press.

Philadelphia, Penn. J. H. HARRIS.

Some Elements of Success

When business slacks off we are apt to hear the expression: "Keep on smiling and the world will smile with you." Then we go along and we see the grim lantern-jawed chap that never smiled in his life collect his bills and pay his creditors and sweep the man with the smile off his feet. All of which makes us wonder if all generally accepted catch phrases should be reversed before being applied.

Just what makes a man successful? Is it ability to accept defeat with a smile and a hope for better days or is it a bulldog grip that refuses to acknowledge defeat and recognizes no rule that says when he shall be counted out? Should a man in business who meets with a loss and finds he has only 99 cents for every dollar he owes go through bankruptcy with a smile, or settle himself to the task of making good even though he passes through the stage where he could pay only 10 cents on the dollar? This latter man we call the hard-headed business man; we all swear by him, and sell him goods—and, leave him alone socially; which in turn brings us to the question of what constitutes success. Even a very few years ago this question would have been answered by nine men out of ten by saying that success consisted in accumulating money.

History is making rapidly now, perhaps more rapidly than ever in the history of the world. We have passed the stage of bloodthirsty conquest, and we are rapidly nearing the end of financial conquests. We are coming into an age of power. When we will reach the age of reason we cannot guess, but today we are worshipping the power of individuals over others. The successful man of today is the man who can employ and govern a mass of people, whether in politics, religion, law, education or shop. Otherwise when men could gather around them enough employees or associates to make a comfortable living they would stop. That is something that men do not do. We all know instances where men have all they want and more, and they put the more back in their business to make it grow. Why? Not because they want more income, for they do not use it when they get it, but because they want power and authority and because in the minds of the masses authority means success.

To get authority today means, not that a man should grasp it by force, but that he should win it by fair dealing and appeal to the better side of all concerned; by the smile that keeps his employees, and his creditors confident through thick and thin. Business success in the present and future must be based, not on rebates and hidden agreements, but on loyalty, and that can only be commanded by men of absolute fearlessness, good nature and fairmindedness. The new slogan is—Smile.

Springfield, Mass. ENTROPY.

The man who has never made a mistake on grit or grade has never selected grinding wheels for many jobs. In grinding, the small chips count. It has been estimated that about 400,000,000 chips per minute are cut off with a grinding wheel with 2 inches face, No. 60 grain, running at the usual working speed. The speed at which a grinding wheel is run is one of the important features which contribute to its success or failure.

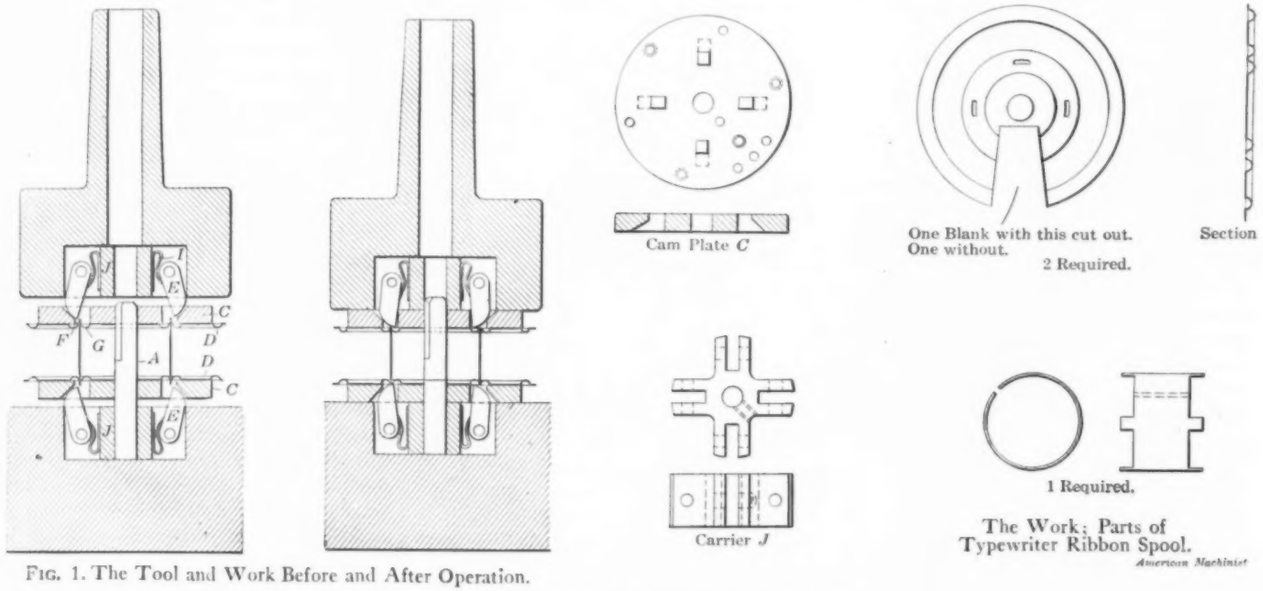


FIG. 1. The Tool and Work Before and After Operation.

ASSEMBLING TOOL FOR TYPEWRITER-RIBBON SPOOL

Discussion of Previous Question

Do Gear Hobbing Machines Cut Flats?

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

When the giants struggle, smaller folk, as a rule, lie low. So I really do not know whether I ought not to be weeding the garden instead of writing this.

My apology is that once on a time I did design a line of spur-gear hobs, which produced reasonably successful and silent gears. And once on a time I did supervise a gear-hobbing department, turning out several hundred gears a week. Further, I am not now interested in the gear-cutting business or anything allied to it and hope I am unbiassed.

In this contrubtion I propose to leave the theory severely alone and talk from experience.

I have seen several thousands of hobbed gears, chiefly between two and ten-diametral pitch. Those who have done likewise (and there are many, especially here in England), will be able to bear out the following observations: On mild-steel hobbed gears with a fairly large number of teeth, flats are sometimes visible and sometimes not. On similar cast-iron gears flats are never visible unless the work is unduly forced. On mild-steel pinions with a small number of teeth, flats are *always* visible. On similar cast-iron pinions flats are sometimes visible and sometimes not. Note the difference between "visible" and "present."

These are my observations from experience. I have also observed that as a general rule the smaller the pinion the fewer the flats, and the broader they are. Also that the greater the number of teeth in the hob the greater the number of flats and the narrower they are.

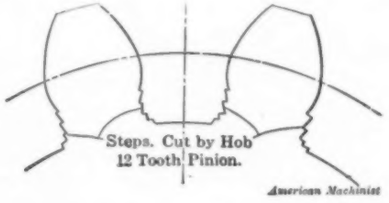
If anyone does not agree with the above let him pick up the next 12- to 18-tooth mild-steel pinion just off the hobbing machine and use his eyes.

Whether the flats represent inaccuracies of 0.001 inch or 0.000001 inch, or anything between, I do not know—I do not care. But I do know that the gears we hobbed, with all their flats, ran at least as well and silently as the gears we milled in the usual fashion, but not as well as planed gears generated with cutters of similar fundamental tooth curves.

Cause of Flats

Several writers have offered the explanation that it is due to the intermittent action of the hob, which has not an unlimited number of teeth. There is a lot to be said on both sides about this. It is theoretically proved that the intermittent action produces a flat. Mr. Groocock's contribution further proves that there is a sort of secondary action tending to modify these flats, but does not prove that it does do this for hobs of ordinary commercial sizes, cutting ordinary gears. Nor has any writer proved this from practical observation. I think it is incapable of *practical* proof.

A practical demonstration of the intermittent action can be seen by inspecting a 10- or 12-tooth hobbed pinion just off the machine. The space at the roots will be something like the sketch shown. The stepped arrangement is due to the intermittent action of the points of the hob teeth as they enter and leave the blank in the interference space.



Steps in the Flank of Hobbed Gears

A Hobber Yarn

In connection with this I have a yarn. I once went to a London exhibition, about the time the gear hobber was first commercially introduced into England from Germanv. I met an old colleague of mine demonstrating these machines. Hand shakes and old-time talks over, we talked "hobbers." Picking up a pinion about 10 teeth 2½ pitch from the bed of the machine, I said, "What's this staircase arrangement down in the bottom of the teeth." "Oh!" was the reply, "you see that's an exhibition pinion. We slotted out those grooves on the shaper to let the light in underneath the working faces. Then folks can see the great accuracy of the contact."

"I see," said I. And that's all I did say. I was too much wrapped in admiration of the tale for farther words.

To return to the subject, a few minutes' thought will show that if these flats were wholly due to the intermittent action of the hob, then, if the hob was always set with one cutting tooth absolutely central the flats would be the same in number, in position, and of the same breadth at any one position, on *every* pinion having the same number of teeth. This is on the assumption that the cutting hob has the same number of teeth in each case compared. This is true whether the pitch be 2 or 20.

Practical observation shows that this is not by any means the case; they vary in number, position and breadth on various similar pinions.

The truth of this is easily tested by observation and needs no mathematical or technical knowledge beyond knowing a flat when one sees one.

The fact that the flats vary in position for apparently similar conditions of hobbing, leads one to look for things in the hobs and machines.

Condition of Hobs

I have tested carbon-steel hobs of various makes by means of a test indicator fixed up in a relieving lathe and found them to be slightly drunken in pitch, to be often slightly elliptical and sometimes barrel shaped. The variation is in cases as much as three or four thousandths. In high-speed steel hobs it sometimes gets to twice this.

Grinding all over after hardening, a somewhat complicated and expensive process, appears to be the only cure for this.

The other point is the possible inaccuracies in the machine.

Absolute accuracy in the product depends, among other things, on the rate of travel of the pitch line of the hob being exactly the same as the linear speed of the pitch circle of the gear being cut. Any variation of this will cause flats.

When we consider that in some of the simplest gear hobbers there are about 14 gears between the work spindle and the hob spindle, and that any inaccuracy in these will be copied in the product, we are bound to admit that there is here a point that needs watching.

I have never tested a machine for such inaccuracies. I once designed a testing set for this purpose which I think would show up any such inaccuracies, but as the set never got beyond paper, I refrain from describing it. It was also designed to study the effect of shaft torsion.

To sum up:

1. The flats are there, sometimes visible and sometimes not.

2. They do not in ordinary gears affect the accuracy of the gear in any appreciable degree.

3. They are partly due to the inter-

mittent action of the hob and partly due to slight inaccuracies in the hobs and machines.

I think the hobbing machine will stand or fall on its output and that it will *stand* on that alone.

Leeds, Eng. J. BUTTERWORTH.

Center Calipers

In reference to the center calipers shown at page 894, Volume 33, Part 2, we are in receipt of a communication from a firm of tool dealers in London, England, from which we quote:

"We beg to inform you that these very calipers were invented on this side of the herring pond more than five years ago. We have been selling them since 1905, and inclose our list herewith, which you will see shows exactly the same thing with this small difference, that Mr. Harris has made the center spindle hollow and inserted a spring."

A Plea for Clearer Drawings

J. Coapman, on page 1073, writing under the above heading, takes a few cracks at the draftsman. It seems to me that the poor draftsman is usually blamed for anything that goes wrong anywhere in the shop.

I don't think there are many drafting rooms where "dimensions are placed promiscuously about, littering up the drawing," nor in any manufacturing plant that lays the least claim to being up to date and progressive, will one find the draftsmen allowed to use their own fancy as to the style of lettering and figuring employed. Indeed, in many shops where only one or two draftsmen are employed, there is a rigid system of dimensioning, lettering, etc., employed; so that the first few weeks of a new man's time are employed more in learning the rule book, than in doing actual work.

System, however, in the drafting room is a very important and necessary requirement and, although rigid adherence to established standards may seem irksome to some individual draftsmen, it results in less friction than where everyone is allowed to do as he pleases.

I believe that most of the up-to-date shops have incorporated in their practice many of the suggestions put forth by Mr. Coapman; i.e., the plainer figures, dropping the inch mark, etc. Any set of figures, however, intended to supplant those commonly used, that does not provide for making some change in the shape of the figure four, will leave room for one of the most commonly met with mistakes; that is, mistaking the four for the nine, when the nine is made with a straight tail. Reference to the accompanying set of figures will show the advantage gained by making the four the same as ordinarily made in writing. Otherwise, the figures shown are identical with those in Mr. Coapman's article, and may be said to be nearly ideal.

I do not see the force of the fable about the green workman who spoiled a lot of work by placing the wrong interpretation upon the abbreviation "R," taking it to mean "ream." The letter "R," to signify radius, has been used for dimensioning fillets and round corners from time immemorial and surely should not be mistaken for anything else. A workman must be green, indeed, who would attempt to ream a round corner or fillet; and likewise, if the radius instead of the diameter of a hole were put on a drawing by a draftsman in such a way that the R might possibly be taken to mean ream, both these men should be gently led to seek some other occupation where their peculiar talents would show to better advantage.

With regard to putting dimensions on drawings so that they all read in the same direction, many shops have adopted this idea with a great saving of the workman's time, due to the non-necessity of turning the drawing at all in order to read

FIGURES AND LETTERS FOR DRAWINGS

all the dimensions. In cases where all the dimensions on the drawings are so placed (and it is just as easy, or easier, for the draftsman to place them so), the drawing can be hung above the workbench and read with ease without handling by the workman, or the necessity of craning his neck to see the dimensions. The avoidance of handling the drawing or print naturally tends to keep it cleaner than otherwise and the possibility of smudging the figures is done away with.

In the matter of a standard alphabet, there is a wide difference of opinion. Personally, I am not in favor of a Gothic alphabet, as the latter consists of capital letters only. The Roman alphabet, slanted and in its simplest form, as illustrated, is undoubtedly the quickest to make and the easiest to read. The Roman alphabet is as near as it is practically possible to make it the ordinary printing type used for nine-tenths of the world's printing. By long association, this style of type and printing is the most familiar of any to the great majority of people, and I believe can be printed and read in one-half the time that it takes for the Gothic style. Besides this, the Gothic letters, and, in fact, any system of lettering using capitals entirely, is very tiring to the eyes, as they are all of the same hight, and closer inspection is necessary to decipher them.

Cleveland, Ohio. S. N. BACON.

Trade Opportunities in Russia

I have read, with much interest, the article on the business opportunities at present open in Russia, to American manufacturers. The article, however, does not do justice to the attractiveness of these opportunities. To the uninitiated a true description would be read in the light of the Arabian Nights applied to commercialism.

I spent 4½ years in Russia, returning home in May, 1909. While there I had charge of work involving a two million dollar contract. This work brought me in business relations with a number of Russian firms and gave me an insight into Russian business methods. By reason of this experience I think the following may be of interest:

The Germans alone understand the true method to be used in the business world in Russia. They send their representatives there, establish their own agencies, adopt Russian methods as much as possible, and educate the people to the superiority of their articles.

No further evidence of their success is necessary, than the very evident fact that the German language is used as much in the modern Russian business world as the Russian language.

I have known of American firms endeavoring to establish a sale of their products by employing these same Germans as their representatives, with the result that the agency is accepted for the purpose only of learning the construction of the article. The American article is then consigned to a dark corner, and the American manufacturer receives a small order from time to time, to persuade him into the belief that his product meets with very little demand in Russia.

On my return to America, I approached a number of American firms, with the proposition of invading Russia, commercially, in a manner which would insure the repaying of the waiting the harvest. I was not surprised at not meeting with success, for the necessary method involves too much time and money for the American, who does not want to wait and for whom a business that requires time and patience to develop has no attractiveness, even although the returns be ten-fold. None but he who has had actual experience in Russia will appreciate the possibilities existing in this land, possessing natural resources as great as those of our own country. The condition is this—a land of immense need, unquestionable natural wealth, inhabited by a

people of latent capabilities, slow to change, but receptive to and enthusiastic for that change if proved of advantage to them. The slav is slow, his immense country is the result of centuries of effort, he will not be hurried.

K. F. VAN BAMGAR.

The Dial Test Indicator for Setting Work on the Lathe

On page 838, Volume 33, Part 2, James K. Cloud, in an article, "An Indicator Center," shows a rather neat way for getting over a difficulty that is often met when setting work, on the lathe, from buttons, that is, when the dial indicator is used. However, the method shown has one drawback.

When doing work of this description it is always advisable, and indeed, generally the practice, to set the buttons from a point as near the jig as possible, both when locating them with reference to some other part, and also when setting the jig on the lathe for boring. This is done because it frequently happens that a button leans slightly one way or the other. By J. K. Cloud's method, the button would be set from the end that leaned if any variation from the square existed. In other respects the idea is first-class, as the center *B* could be used for setting from a center-punch mark when doing jigs where a wider limit is permissible.

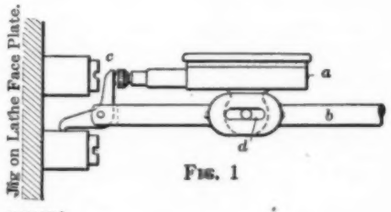


FIG. 1

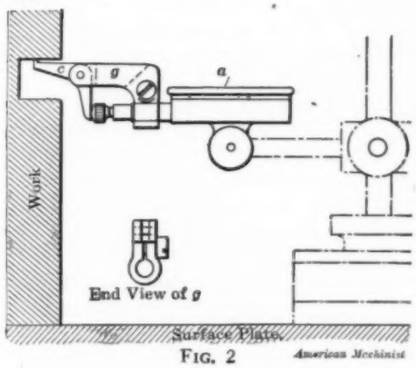


FIG. 2

SETTING WORK

Two of the best methods known to me for changing the direction of movement of the dial indicator plunger so as to accommodate this class of work, are shown in Figs. 1 and 2, both methods being very useful, and effective; not only on the lathe, but also on the examination table, and the bench, for getting at surfaces so placed that the dial would foul if placed in a vertical position.

In Fig. 1 *a* is the dial indicator and *b* is the carrier, in the end of which the bell-cranked lever *c* is carried. This lever *c* is 1/10 inch thick and should be a nice working fit in the slot, where it is held in position by a pin that acts as a fulcrum. It may be held up to the indicator button, by a very light wire spring, which however, must be weaker than the spring of the indicator. The best way is to harden the ends of the lever and then magnetize it. This will be sufficient to prevent the lever falling, as it will cling to the indicator button. The arrangement, Fig. 1, represents the rig as applied to setting a jig on the lathe when two buttons are close together. It will be noticed that the carrier *b* is slotted at *d* to allow the indicator to be used under varying conditions.

Fig. 2 shows another method. In this, the bell-cranked lever *c* is carried in the bracket *g* that clamps on to the indicator stem, and releasing this bracket, by means of a screw, it may be turned in any direction, up, down, or sideways, while the dial remains horizontal, and thus in the easiest position to read.

The indicator is shown in Fig. 2 as used on the surface plate when testing the under side of a slot in a jig. The levers *c* can be made any length, and if a long arm is used one gets a multiplying effect, but generally at the expense of steadiness. By having a lever, the outward end of which is ground like a center punch, the indicator is directly applicable to the commoner type of jig where the center-punch mark is sufficiently accurate. The arrangement as shown in Fig. 2 is so simple to make, and adds so much to the utility of the dial indicator, that one wonders why the makers of such instruments do not make and sell a similar attachment to go with them.

WALTER G. GROOCOCK.

London, England.

Trade Schools Again

Some of us remember the old "New England Primer." In it was a picture of a boy in a tree and a man throwing grass at him. The story runs that the man wished the boy to come down but that the latter preferred to stay up and was a little inclined to ridicule the man for throwing grass. Later on the man threw rocks and the boy came down in contrite spirit and torn clothes.

I am reminded of this by Mr. Kreuzpointner's article at page 1108, Volume 33, Part 2, in which he kindly requests those who are throwing rocks at the professional educator to desist. If I remember right we have been throwing grass his way for some years but with no other effect than the grass had in the time of the old primer. In 1834 there was founded in Worcester the "Worcester County Manual Labor High School" with a board of trustees composed of four clergymen and 10 "practical men." This has since become the Worcester Academy, a preparatory school for college exclusively.

Not content with this attempt to provide for the vast majority who never see a college, some public-spirited citizens founded the Worcester County Free Institute of Industrial Science with three clergymen and a majority of practical men as a board of trustees. This was by its deed of gift made a trade school in the present sense of the word. There are usually several ways of interpreting a written statement, so now this is the Worcester Polytechnic Institute, an engineering school with college-entrance requirements.

Now they have the Worcester Trade School with a board of trustees minus clergymen and composed of men who, if they have college degrees, have also taken post-graduate degrees in the school of hard knocks. The question is, how long will the Worcester school be a trade school? I predict that it will stay a trade school, because the manufacturers and merchants of Worcester have quit throwing grass and are using rocks.

If Mr. Kreuzpointner speaks for the professional educator and if it is a fact that the latter is shouting, "Don't shoot, I'll come down," it may be well to let up a trifle and see whether they will do it or not, but I advise having a few rocks handy just the same. What we are after is something for the 98 per cent. of our children who do not graduate from college. They do not all want to learn trades, but there are more who are fitted to learn trades than there are who are fitted to go through college.

Here in Massachusetts we put a law on the books 38 years ago allowing the public-school authorities to establish trade schools. They took no advantage of it. After waiting with more or less patience for 35 years and seeing nothing done, the public finally decided to do something. It has established independent industrial schools, which means that the schools must have an organization independent of that of the public-school system.

Mr. Kreuzpointer evidently would consider this law as a "miscarriage of effort" and would say that society should take care of the matter, which is precisely what society has done. It has said to the professional educator, "You have had your chance, we have told you what we need and you offer us something else; now we will get someone to do this work who is willing to do it."

Mr. Kreuzpointner is correct; society made the present condition of the school system, but it made it by neglecting its duty of seeing that education was for all rather than the few. For years it has seen its error and has thrown grass. Now

it is throwing rocks. Will they come down? Have they come down? And will they stay down?

Springfield, Mass. ENTROPY.

Automobile Engine Proportions

On page 483, Volume 33, Part 2, appeared the first section of some articles under the above heading by Messrs. E. G. Kessler and G. W. Lewis. In this article reference was made to a number of automobile associations, which calculate the horsepower of a 4-cycle, 4-cylinder gasolene motor by certain well established empirical formulas. Furthermore, these formulas were used to deduce an average formula for normal performance in horsepower, and a formula for maximum output in horsepower was calculated from experiments.

In all of these formulas, the constants fixed by the various associations and by the authors, combined, according to our German idea, both constant and variable quantities. It is, therefore, of interest to compare these various formulas one with another, and to discover what variable quantities are contained in these constants. In the formulas under consideration, the assumption was made that the revolutions of the engine were such that the piston speed was 1000 feet per minute and, by comparing these various formulas with the regular, rational, horsepower formula, it is possible to figure the mean effective pressure, which must be acting upon the piston to develop the calculated horsepowers. The results of these calculations are given below, all being based upon an example of a four-cylinder, four-cycle, automobile engine, with 4-inch bore and 4-inch stroke, running at a speed of 1500 revolutions per minute, corresponding to 1000 piston speed per minute.

MOTOR-CLUB FORMULAS

According to the formula of the Association of Licensed Automobile Manufacturers, the horsepower of this engine will be 25.6; then, applying the rational horsepower formula, we find the mean effective pressure must be 67 pounds per square inch. Applying the formula of the Royal British Automobile Club, we find that the mean effective pressure must be 68 pounds per square inch. By the French Automobile Club formula, this pressure will be increased to 75.4 pounds per square inch, while the formula of the Royal Swedish Automobile Club gives the mean effective pressure as 66 pounds per square inch. The formula of the New York Motor Boat Association gives a very much higher value, namely, 77.8 pounds per square inch; but as, according to the statement of the authors, this formula is applicable to comparatively slow-running marine motors, this formula may well be left out of our consideration of automobile engines. The average of all these mean effective pressures for the automobile engines will then be 69.1 pounds per square inch.

In the article in question the authors go on to derive the formula for the maximum horsepower which may be developed by such an engine and, applying this to our example, we find that the mean effective pressure must be 75 pounds per square inch.

TESTS OF LAY AND EVANS

Now, if we vary the speed of the motor, as was done in some brake tests recently published by Lay and Evans, of a four-cycle, four-cylinder engine, having 4x4-inch cylinders, with speed varied between 700 and 1500 revolutions per minute, we find the following sets of results: Speeds, 700, 1000, 1200, 1500 revolutions per minute; brake horsepower, 12.4, 17.1, 19.5, 21.4. From this may be deduced the following mean effective pressures: 70, 67.4, 64, 56 pounds per square inch. From a second set of tests by the same experiments, the following results were found: Speeds, 700, 1000, 1200, 1500 revolutions per minute; brake horsepower, 12.2, 16.8, 21.4, 23.2. From these were calculated the mean effective pressures to be as follows: 68.3, 66.0, 70.3, 60.9 pounds per square inch. From these tables it appears that the mean effective pressure decreases with speed, since the one exception in the second set, at 1200 revolutions per minute, manifestly is due to an error of some sort.

TESTS BY GULDNER

Now, again taking the example of a four-cylinder, four-cycle motor having cylinders 4x4 inches, running at a speed of 1500 revolutions per minute, we may calculate the horsepower according to the average formula, for the four automobile associations already mentioned, giving 26.60. According to Güldner (*Zeitschrift des Vereines deutscher Ingenieure*, 1902, page 606), this motor, with fuel having a value of 19,800 B.t.u. per pound and consuming 281 cubic feet of air per pound of gasolene; and assuming the volumetric efficiency, as this author did, of 0.50 to 0.60 (Lay and Evans figure 0.53) giving an efficiency of 23 per cent.; we have 18 horsepower for 1500 revolutions per minute. According to Lay and Evans results at this speed, as given above, this would be 21.4 horsepower. This power it would, therefore, appear, corresponds to the maximum power of the motor, while the 18 horsepower denotes the normal horsepower for 1500 revolutions per minute. From this it would seem that the average formula of the four associations gives results about 48 per cent. too high for the brake horsepower, as compared with the Güldner formula.

In all cases herein, the mean effective pressure has been figured upon the basis of brake horsepower because the formulas of the four automobile associations are for brake horsepower. This may then be called the *useful* mean effective pressure. The actual mean effective pressures of the gases within the cylinder would be obtained by dividing these figures by the mechanical efficiency of the engine.

ROBERT DIETRICH.

Bielefeld, Germany.

Economy in End Mills

I was interested in J. H. B.'s letter on page 550, Volume 33, Part 2, on the above subject. For several years I have made end mills on the same principal, but I never cut teeth on the end. When making an end mill a hole is drilled up the center the whole length of the teeth and the end is turned hollow for clearance. This holds good for most jobs, but in a case where a keyway has to be sunk I drill a starting hole with a twist drill ground flat on the end. When a breakage occurs rough grind on a wet sandstone or emery wheel and finish by hollow grinding on the cutter grinder using a half center.

Leicester, Eng. A. KIRKLAND.

Keys for Shafts

On page 1008, Volume 33, Part 2, under the above heading, formulas are given for the relative strength of shafts and keys as applied to automobile work. The formulas given and values taken show that, while the resisting moment of the shaft is 10,600 inch pounds, that of the key is only 7500 inch pounds. It is then stated that this does not indicate consistent design, in that the shaft is stronger than the key.

Assuming a shaft and key of equal strength and that failure occurs, the failure might take place in either the shaft or the key; but, as the key is cheaper to replace than the shaft, it would seem that the 2-inch length of key is the one to use, rather than the 2⅞-inch length, as suggested. If the key is not strong enough, increase the size of shaft and key, but keep the shaft stronger than the key.

This same proposition came before the writer within the past week, except that the case was a flanged coupling in which the shearing strength of the bolts was purposely made less than that of the shaft; so that, in the event of overload, the bolts will fail (the cheaper to replace), rather than twist off the end of an expensive shaft.

Newburgh, N. Y. J. K. MCINTYRE.

Micrometer Boring Bar for Car Wheels

By R. R. Wen

Boring bar with improved micrometer attachment and so arranged that adjustment of finishing cutters can be made while roughing cutters are in operation, thereby saving time enough for one man to operate two machines.

Steam, as well as electric railway companies have experienced considerable difficulty in fitting their wheels and axles, on account of not having a reliable check on their work and a system of doing it which would insure not only accuracy, but a quick method, with first-class workmanship.

Most of the shops have had different ways of fitting up their wheels and axles; a brief outline will give an idea of these methods. Some shops bore out the wheels to some desired standard and then turn their axles to fit the wheels. Others try to bore out the wheels so that it will not be necessary to turn any more off the axle than necessary to make a true wheel seat, this, of course, being done to increase the life of the axle, which is a point well worth considering.

There is another popular system which is generally used; that is, the use of snap gages which vary one-sixteenth of an inch in size. The idea of this is to turn all axle wheel-seats to these gages and to bore out the wheels to a proper size to mount on these axles, thus aiming to have an axle suitable for mounting in any wheel fitted to the same snap gage. After following this method for a number of years, which was supposed to be the best method in use, it was found to be unsatisfactory, mostly on account of turning so much material off the axle in order to obtain the desired fit, thereby lessening the life of the axle. Also, the use of snap gages by many different men was found to be very far from accurate, resulting in about 30 per cent. misfits.

This, then, became a serious proposition for the railroads to overcome and there arose the question: "How to fit the axle to the wheel or the wheel to the axle, to do it quickly, and to assure first-class workmanship on both?" This question was taken up and settled at the Master Car Builders' convention, which was held at Atlantic City last June, when a resolution was passed that the wheel should be fitted to the axle and not the axle to the wheel, as was the universal practice at almost all railroad shops.

This method is being successfully worked out at Pitcairn shops of the Pennsylvania Railroad Company, by the use of an expansion boring bar with a micrometer adjustment and micrometer calipers for measuring the axles. The above mentioned tool was designed and put into service by their shop foreman, John J. Steinbrunn. The general arrangement of the bar is shown in Fig. 1. The micrometer attachment is shown in Fig. 2.

A brief description of the bar is as follows:

The bar is provided with two sets of radially arranged cutters, one set for taking the rough cut and the other the finishing cut. The object of this relative arrangement of the sets of cutters is that, the bar being originally set central with the hole desired to be finished, any inaccuracies of alinement arising during, or resulting from, the first cutting operation, are not necessarily repeated by the following cutters; but that said cutters and the bar will reassume their central arrangement with relation to the work as soon as the cutters have passed beyond it, and before the finishing cutters have commenced their work.

As stated, the cutters are adjustably mounted within the sockets of the bar and, for the purpose of adjusting them outwardly therein, equally at each side, the adjustable blocks have their inner, middle portions cut out or recessed semi-cylindrically, and tapered to the same degree as the taper of the adjusting wedging screw. These blocks are loosely assembled by means of bolts extending through one block and screwed into the other block, the heads of the bolts engaging in an elongated recess in the outer sides of the blocks, sufficient play being provided to permit of the necessary separation of the blocks by the wedging screw, to effect the outward adjustment of the cutters. The adjusting blocks are of a hight corresponding to the hight of the cutters, which abut with their inner ends directly against the outer faces of their blocks, providing a solid contacting bearing for each cutter.

The wedging screw having its shank provided with threads engaging receiving threads in the bar, the middle portion of the screw is tapered in truncated-cone form, while beyond such tapered portion it extends into the bar with other threads engaging receiving threads in the bar. It will be understood that the curvature of the openings in the blocks is of a radius to snugly receive the tapered wedge, and provide a bearing therein when it has been adjusted inwardly to the limit of its movement.

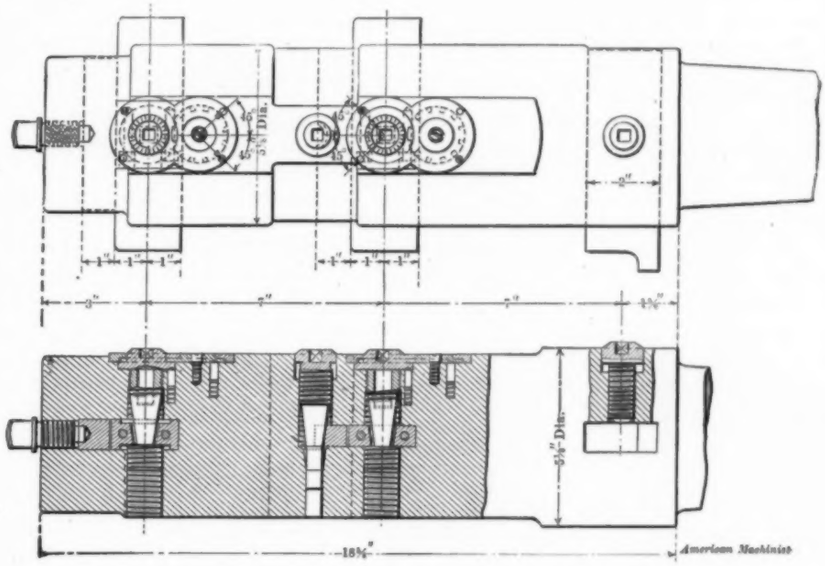


FIG. 1. MICROMETER BORING BAR FOR CAR WHEELS

A particular advantage of the threaded, inner terminal extension of the screw and its engagement with threads beyond the cutter blocks in exact alinement with the threads on the near side of the cutter, is that the adjusting screw is thus always maintained in perfect alinement, rendering it impossible to adjust either cutter in advance of the other.

The finishing cutters are held in their

position by means of a gib and tapered screw, while the roughing cutters are securely held in their position by means of a gib and a set screw in the end of the bar.

The advantages of the construction reside in its adaptability to making a continuous cut through the hub, following one cut immediately with the other, without any necessary change in the bar or substituting one cutting tool for another; also, in facility for making an accurate adjustment for the finishing cutters while the roughing cutters are passing through the wheel. The broad range of the dial representing the expansion of the tools in thousandths, gives this bar the greatest accuracy. Every one-thousandth movement of this adjustment is firmly held in place until moved by a wrench for this purpose.

As I have given the former practice which is generally used in fitting up wheels, it will be well to give a brief outline of what this new tool is doing, and the system of carrying on the work. The axles when received at the shop for re-turning are carefully inspected. If the wheel seat shows evidence of previous bad turning, or should micrometer caliper measurements show any two diameters on a single wheel seat varying over three one-thousandths of an inch, the wheel seat is turned as large as possible to true up similar to wheel-fitting method. After the axle is turned, it is again calipered with micrometers, and the size marked with chalk on the axle near the wheel seat. From these sizes a list is made for boring-mill men to bore wheels, allowing proper amounts for draw.

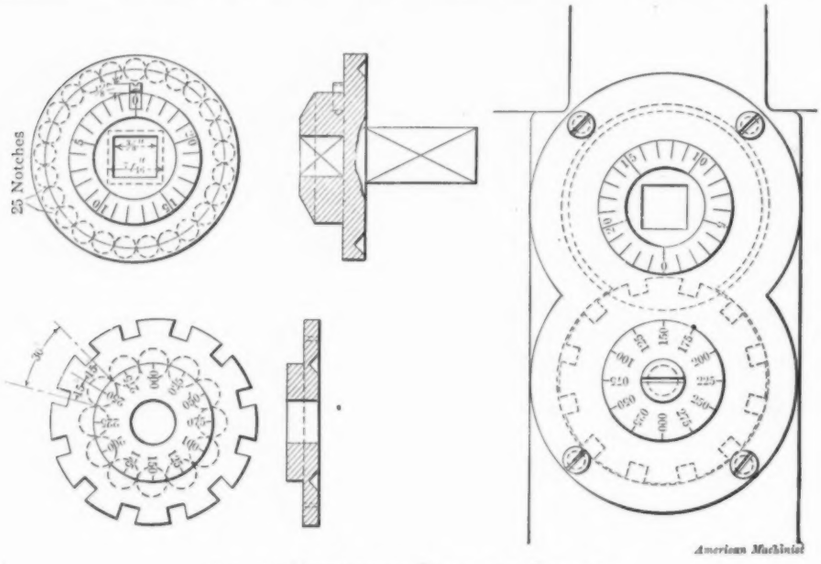


FIG. 2. MICROMETER DIALS FOR CUTTERS

The boring-mill man bores to the various sizes shown on the list given him by the inspector. Afterward, the wheels are mounted on the axle for which they are intended. By this method the use of ordinary calipers for fitting wheels, other than using them to measure the wheel seat to see that they are round and straight, has been eliminated entirely.

For an example, we will consider that we are boring wheels to fit some of the larger-sized axles for 100,000-pound capacity cars, with a standard wheel seat of 7 inches. When the axles are turned up, after calipering several wheel seats we find the list to contain the following sizes: 6.972, 6.852, 6.911, 6.937, 6.949, 6.813, 6.824 and 6.793 inches. I do this to show how the sizes are given to the boring-mill men to bore out wheels to fit the axles which were calipered. After the wheels are bored out, these sizes are marked on the tread of the wheels, and the men who are doing the mounting can easily match the wheels by corresponding the size marked on the axle they were bored to fit. By this method there are not over 5 per cent. of misfits.

By the use of this tool, wheels are bored as quickly as by the old method of boring to any ordinary size, the average output of one mill being about 75 or 80 wheels in 10 hours. One man can operate two mills, which means an output of at least 150 to 160 wheels per day.

It readily can be seen by the practical man that a wonderful saving has been brought about in the life of axles, and not only this, but first-class workmanship is assured. Every axle is measured by a micrometer, and any axle found to be three-thousandths of an inch tapered, or two-thousandths of an inch out of round, is not fitted up. All that is left to do is to assure the desired amount of draw and the wheel is sure to fit properly. Thus, by the use of the device and method described above, there are no loose wheels to worry about, which have been the cause of so many wrecks on the different railroads throughout the world.

English Drill Speeds and Feeds

BY H. PEARMAN

The accompanying table shows what we are doing with high-speed twist drills from ⅛ to 1 inch in four different materials. The information includes speed of drill; feed per revolution; cubic inches removed per minute, as well as data regarding the horsepower required.

Drill Diameter.	Brass.			Cast Iron.			Soft Steel.			Hard Steel.			H.P. in Cast Iron.			
	R.P.M.	Feed per Revolution.	Cubic Inches Removed per Minute.	R.P.M.	Feed per Revolution.	Cubic Inches Removed per Minute.	R.P.M.	Feed per Revolution.	Cubic Inches Removed per Minute.	R.P.M.	Feed per Revolution.	Cubic Inches Removed per Minute.	Cutting H.P.	Feeding H.P.	Total H.P.	H.P. per Cubic Inch Removed.
⅛"	3054	0.0032	0.225	1782	0.0063	0.131	2559	0.002	0.188	1528	0.0028"	0.112	0.169	0.0051	0.1741	1.33
3/16"	2037	0.0042	0.382	1189	0.0073	0.224	1707	0.003	0.3217	1020	0.004"	0.192	0.254	0.0056	0.2596	1.16
¼"	1531	0.0055	0.563	893	0.008	0.328	1282	0.004	0.472	765	0.005"	0.281	0.338	0.0061	0.3441	1.05
5/16"	1223	0.0059	0.758	714	0.0086	0.442	1025	0.0043	0.635	612	0.0055"	0.379	0.423	0.0063	0.4293	0.97
⅜"	1019	0.0062	0.957	595	0.0092	0.564	854	0.0048	0.809	510	0.006"	0.483	0.508	0.0067	0.5147	0.913
7/16"	872	0.0068	1.189	509	0.0096	0.694	731	0.0052	0.995	437	0.0065"	0.594	0.592	0.007	0.599	0.863
½"	765	0.007	1.423	446	0.0101	0.831	642	0.0058	1.193	382	0.007"	0.713	0.676	0.0072	0.6832	0.822
9/16"	681	0.0075	1.665	397	0.0105	0.972	570	0.006	1.397	340	0.0075"	0.833	0.762	0.0074	0.7694	0.79
⅝"	613	0.008	1.911	357	0.0109	1.115	513	0.0063	1.6	306	0.008"	0.956	0.846	0.0076	0.8536	0.765
11/16"	554	0.0085	2.161	323	0.0112	1.266	464	0.0065	1.819	277	0.008"	1.184	0.932	0.0078	0.9398	0.74
¾"	519	0.009	2.466	297	0.0115	1.439	427	0.0068	2.32	255	0.0083"	1.232	1.015	0.008	1.023	0.712
13/16"	470	0.0095	2.71	274	0.0118	1.584	394	0.0069	2.278	235	0.0085"	1.358	1.10	0.0081	1.1081	0.7
⅞"	436	0.010	3.0	254	0.0121	1.75	365	0.007	2.515	218	0.0088"	1.499	1.183	0.0083	1.1913	0.633
15/16"	408	0.0105	3.29	238	0.0124	1.919	342	0.0071	2.755	204	0.009"	1.643	1.269	0.0084	1.2774	0.665
1"	381	0.011	3.58	222	0.0127	2.087	319	0.0072	2.996	191	0.0092"	1.792	1.353	0.0086	1.3616	0.651

TABLE SHOWING ENGLISH PRACTICE WITH HIGH SPEED TWIST DRILLS.

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American Machinist

Where the Iron Goes

Although we actually know better, we are quite apt to think of iron and steel as practically indestructible, so that when we realize what an enormous quantity of new iron is continually being mined and manufactured and apparently added to the world's stock of material, the wonder is that the available pile of usable metal does not rapidly increase. The fact is that only a small portion of our new acquisitions of iron becomes permanently available stock to be scrapped and used over and over. Probably not more than a quarter of the world's stock of iron is scrapped and used a second time, and, of course, not more than a quarter of this goes through a second scrapping.

We get many suggestions as to where and how the iron is dissipated, or, as we say, consumed; this consumption being as complete and final for the portions considered as the consumption of coal or wheat. In the processes of manufacture, in the melting and forging, there is burning of metal, and in all the cutting operations of the shops there is waste, only the larger chips representing recoverable material. The dissipation by wear is more rapid than one would think. Doctor Soper, in a recent valuable paper before the Boston Society of Civil Engineers, says that he found that, by actual record of material replaced, there was produced in the New York subway, from the brake shoes alone, one ton of iron per month per mile. The waste of wheels and rails was not so easily ascertainable, but is to be added to this. The same rate of iron-dust production was estimated for the elevated railroads, while the same process was also in operation on the surface roads and, more slowly, of course, with all running vehicles.

On the big railroads account is kept of the weight of the cars in use. A large number of steel hopper cars showed an average loss of weight of 702 pounds the first year, with continuous losses, not always at the same rate for subsequent years. Some of this loss, of course, was due to wear and some to rust. The rusting of iron goes on always, and in some extensive lines of manufacture, as for instance wire fences, and the various iron articles in domestic service, the entire output ultimately goes to rust. Old iron lies around everywhere, some of it too small and much of it too insignificant to be individually noticed, slowly disintegrating, some of it going into the air, some into water and some into the soil, and through these media into untraceable combinations and activities.

Doctor Soper, in the paper referred to above, says that he has never found any dust anywhere in New York which had not iron in it. He was consulted as to the discoloration by iron rust of the new white marble Metropolitan Life Building. It was suggested that there was iron in the marble, but he went to the quarries at Tuckahoe, where the marble came from, and found houses in the neighborhood, built years before of the same material, which are still white and without this characteristic stain. Then he collected dust on the different stories of the building and always found iron enough to account for the discoloration. "It would be an interesting thing," he says, "for anyone who is at all concerned about dust, and curious to know how much iron there is floating around in the atmosphere he breathes, to scrape up a little dust—perhaps from his bookcase, or somewhere else in his home or office—take a common ten- or fifteen-cent horse-shoe magnet and pass it over the dust. Or, preferably, if the dust is scattered on a piece of paper, take the magnet and pass it back and forth under the paper. In the last case, with the magnet moving under the paper, the sharp eye will see some of the particles rearing themselves on their hind legs, so to speak, and waving back and forth in accordance with the amount of magnetic attraction beneath."

All this is curious and interesting and provocative of thought. We cannot but wonder, when we note what is going on, how the masses of iron were first collected and deposited in comparative purity in isolated spots all ready for the miner and the manufacturer, and then we may wonder still more how all the iron scattered by man's activities in infinitesimal particles through the air and over all the earth is ever to be collected and deposited again for the miners who will still be seeking iron in the ages out of sight ahead. So far as imagination can outline the future plan of the universe, with the tendency everywhere from the homogeneous to the heterogeneous, there is no hint of any reassembling of such material as in the primeval aggregations. We must go on mining and comminuting and scattering with no intelligent thought as to what is to be the climax. If we ever think for a second of the possibility of exhausting our supplies, especially of the metals, we have only to remind ourselves of the specific gravity of the earth. As long as that is above 5, we know that in the constituents of the mass the metals are decidedly in the majority, and the meteors which are flung at us

assure us that steel is plentiful in the universe.

A Little Courtesy

How many firms, after they have asked for and received bids take the trouble to write a courteous letter to the unsuccessful bidders, thanking them for their proposals, stating that the contract has been placed elsewhere and that they will give them further opportunity to submit figures as occasion may present itself. We venture to guess that many firms do not extend this little courtesy. It is a small matter, to be sure, one that may not make any difference in dollars and cents to the firm which does or does not do it, and yet it contributes to the sum total of pleasant relations in business life. The bidder who is really looking for work is naturally interested to know whether or not he is going to get it. The courteous letter closes the incident as far as he is concerned and at the same time thanks him for the trouble and expense to which he has been put in preparing the estimate.

If you are not in line, why not make it a rule of your office to send out a letter of this kind to all unsuccessful bidders?

The Test of Industrial Education

If the recent meeting of the Society for the Promotion of Industrial Education showed one thing more plainly than another it was that the publicly supported trade school will be tried out. So far the experiments that are being tried are all meeting with an excellent measure of success, whether they are full-time, half-time or continuation schools. It should however, be borne in mind that every one of these schools is in the hands of its friends and promoters, that is, the men in immediate charge are men who have taken their jobs because of their belief in something in which they are pioneers. They will succeed in a large measure, as pioneers always do, because they have an open field and nothing as a basis of comparison. The true test will come only when the movement becomes sufficiently widespread to enlist the services of other men, men who are content to follow in the footsteps of their more adventurous predecessors.

How will each of these types of schools fare when they are left to such men? The comparison has been aptly made with the plays which in themselves have been great and those which have served as a vehicle for the greatness of star actors. Which of these forms of trade school will prove to be the Shakspere of industrial education? It must be conceded that if publicly administered trade training is to be successfully carried over the length and breadth of the land it must be by some system of sufficient intrinsic merit and simplicity of administration that a large number of men may head a large number of schools. The problem is not solved by the successful establishment of one or a dozen or a hundred schools. It will only be solved when every community or nearly related group of communities has its own school.

New Publications

Notes on Mechanical Drawing. By Horace P. Fry. Sixty-one 6x9-inch pages, with numerous plates, text, cuts and tables. The University of Pennsylvania, Philadelphia, Penn.

Without attempting to be in any sense a treatise on mechanical drawing, this compact volume sets before the student the numerous conventions and methods of procedure which everyone must learn and which may be placed before the student, more effectively in printed form than by verbal instruction of the teacher. Most of the conventions are generally recognized and used, and while some are not, the same statement could be made of any possible set of conventions that aims to be at all complete. While we might take exception to a few of the things included, the fact remains that most of the conventions show a correct conception of mechanical drawings as made for use in the machine shop.

Machine Drawing. By Gardner C. Anthony. One hundred and four 7½x5¼-inch pages with 127 illustrations, 6 tables. D. C. Heath & Co., Boston, Mass.

This work deals with mechanical drawing from the elementary to the finished product. The first portion of the book is devoted to standards, such as screw threads, bolts and nuts, with directions for representing them in drawings. One chapter is devoted to the purely elementary side of making drawings; that is, as to paper used, tracing, shade lines, lettering, etc. Another chapter is devoted to sectional views with directions for representing surfaces, choosing the best cutting planes and what to show and not to show in sections. Dimensioning is fully dealt with in another chapter showing the best dimensions to put in and where they should be placed, with a section devoted to the reading of a drawing with reference to finding the dimensions.

Technical sketching in free hand forms the matter of another chapter and the book proper closes with thirteen examples from actual machine-shop practice, including a great many of the more important parts of well known machines.

Various tables are included, giving standard threads, standard washers, cotter pins, pipe and flange and pipe-fitting dimensions, tapers, keys and decimal equivalents.

Personals*

H. C. Pierle, who has been in the employ of the Le Blond Machine Tool Company for some time, becomes advertising manager, to succeed H. L. Beeler, recently resigned.

C. R. Harris, until recently chief inspector with the American Car and Foundry Company, has become general superintendent of the Morgan Motor Truck Company, Worcester, Mass.

George D. Hayden, for the past seven years with the Davenport Machine Tool Company, of New Bedford, Mass., is now connected with the Screw Machine Product Corporation, of Providence, R. I.

William E. Gray, who was formerly secretary of the Skaneateles Paper Company, has assumed the position of general sales manager of the Enameled Pipe and Engineering Company, Elyria, Ohio.

Ezra L. Blanchard, for the past 11 years superintendent of the Union Electric Light Company, Franklin, Mass., has resigned in order to accept the superintendency of the United Electric Light Company, Roxbury, Mass.

George T. Frankenburg, until recently mechanical engineer of the Ralston Steel Car Company, East Columbus, Ohio, has joined the Cambria Steel Company, Johnstown, Penn., acting in the capacity of general outside foreman.

Professors Kennersen, Brooks and Phetteplace, of Brown University, Providence, R. I., have associated, with headquarters thereat, for the purpose of testing and advising in regard to the development, transmission and use of power.

W. P. Pressinger has disposed of his interest in and resigned as vice-president of the Keller Manufacturing Company, Philadelphia, Penn., in order to become manager of the compressor department of the Chicago Pneumatic Tool Company, with headquarters in New York.

W. S. Chase, manager of sales of the National Acme Manufacturing Company, Cleveland, Ohio, and P. C. Ryan, advertising manager of the same company, sailed on January 14 for an extended business trip in Great Britain and the continent, during which they will arrange for branch offices in England.

In reporting in this column in a recent issue, the promotion of C. C. Tyler, formerly manager of the Remington Arms Company, to the newly-created position of general manager of works in charge of the general administration and operation of the Remington Arms Company, of Ilion, N. Y., and the Union Metallic Cartridge Company, of Bridgeport, Conn., his name was erroneously printed as C. C. Taylor.

*Items for this column are solicited.

Shop Equipment News

Cincinnati Ten-Sixteen Boring Mill

The accompanying halftone engravings illustrate a new boring mill which is built by the Cincinnati Planer Company, Cincinnati, Ohio. The machine shown is their 10-16-foot extension mill; it is also built as a 10-foot standard machine without the extension base, the actual capacity of the mill in this form being for work up to 10 feet 6 inches diameter, and 5 feet 6 inches in hight, while the extension mill illustrated has a maximum capacity of 16 feet 3 inches diameter.

In Fig. 1 the machine is shown with the housings in their forward position, while Fig. 2 shows them extended to their limit and with an extension arm in place upon the front of the cross rail. These views give a clear idea of the general proportions and chief features of design.

The bed is of box form, 21 inches deep, with all parts strongly ribbed and braced, and the entire mechanism is supported on the bed so that no foundation aside from that for the base is required, and the proper alinement of all parts is insured. The table is 10 feet in diameter and 10 inches deep at the edge. It is supported on a broad, flat, annular bearing 9 feet 5 inches in diameter, and the massive center spindle runs in a bronze-bushed bearing which is adjustable to compensate for wear. At the bottom a step bearing is provided which may be adjusted to take more or less of the load, as desired, or to raise the table sufficiently for operating at high speeds.

ANY and all new or improved machines, tools or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here — the machine shop news.
A more full and detailed description will be given — when it is real news — if it can appear here first — before it is sent to other papers. ALL descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German

The large internal driving gear is cut from the solid and operated by a pinion made from a forging. It is driven by a 20-horsepower, 2 to 1 variable-speed motor. This, in connection with the speed box, which provides four changes, gives a ratio of 36 to 1, the minimum table speed being 0.4 and the maximum 14.4 revolutions per minute.

A special five-horsepower motor elevates the cross rail, and in the case of the extension mill, another five-horsepower motor is used for moving the housings backward and forward. These housings, are of box form with 12-inch face, and have long, broad bases to insure rigidity under severe duty. In addition to the heavy top brace between the uprights, a cross brace is provided at the back; this is in the form of an X and takes care of any side strain due to heavy cuts when the cross rail is some distance above the table.

The cross rail is 30 inches deep and weighs with the heads over 22,000 pounds. It is of box section and deeply arched at the rear to reduce deflection, due to weight of heads or pressure of the cut. It is secured to the uprights by clamps not only on the outer edge of the housings, but also on the inside, so that it is secured rigidly at its weakest point.

The heads have a 34-inch bearing upon the cross rail, with both guiding surfaces on the lower part of the rail, reducing the cramping action, and providing a long narrow bearing that gives smoothness in traversing the heads. The

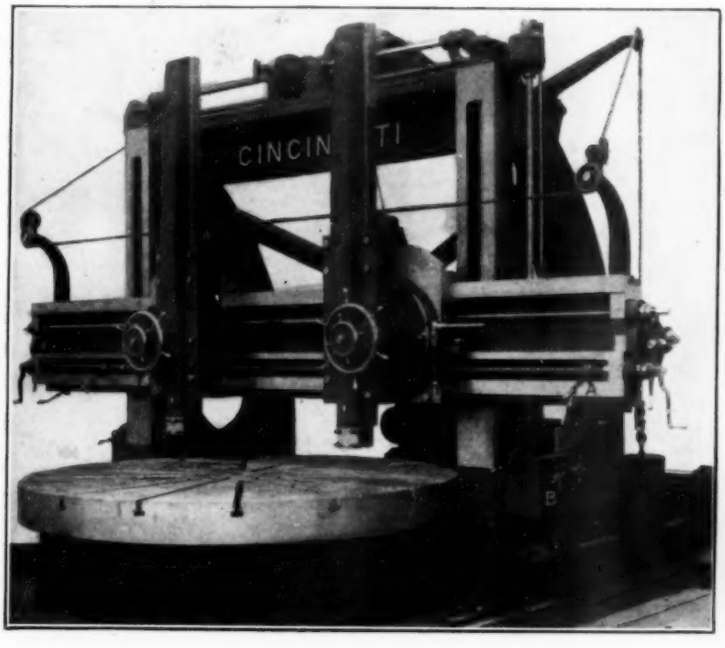


FIG. 1. CINCINNATI 10-16-FOOT BORING MILL

FIG. 2. BORING MILL EXTENDED TO LIMIT WITH AUXILIARY ARM ON CROSS RAIL

tool bars are steel castings of large box section, have a travel of 48 inches and are separately counterweighted. Both heads have power rapid traverse on the rail for raising and lowering the tool bars, or they may be moved rapidly by hand.

An important feature is shown at *A* for adjusting the head accurately after it has been run approximately to place by power. This is a form of ratchet lever on the cross-feed screw. As the head is traversed by power this lever, which normally hangs free on the screw, is slid along to a convenient position. Upon releasing the quick traverse, the operator grasps the lever, closes the spring latch and engages a member splined on the feed screw so that it can be turned to set the head accurately to position.

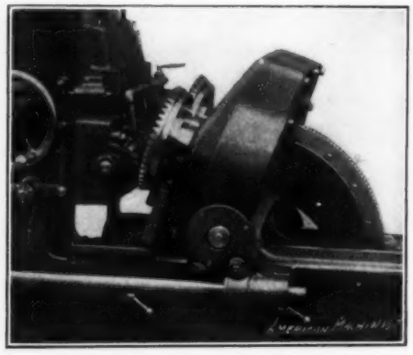
The feed box is attached to the housing at *B*, a separate box being provided for each head, so that they have independent feeds in all directions. Each feed box gives eight changes for its head, ranging from 1/32 to 1 inch per turn of table.

The feed clutches on the ends of the feed screw and feed rod are so controlled by the lever pivoted at their rear as to make it impossible for the two feeds to be engaged simultaneously. The clutches also prevent the crank handle for hand feed being engaged while the power feed or the power quick traverse is engaged, thus doing away with liability of injury to the workman from this source. The double-ended clutch member is splined to slide along on the end of the feed screw or rod, and may be engaged with the feed gear for the operation of the power feed, or it can be slid into mesh with the clutch teeth on the crank handle, for hand feed of the head. The crank handle, however (which normally hangs free on the end of the feed screw), can be slid inwardly only a certain distance, owing to a stop shoulder, and, when the clutch member is connected with the power-feed gear, the shoulder referred to prevents the crank handle from being moved into engagement with the clutch.

The extension arm carries an auxiliary swiveling head with a bar 6 inches in diameter and having a vertical movement of 48 inches by hand or by power. It is counterbalanced independently and the extension arm is so arranged that it can be readily removed at any time.

Multiple Bevel Gear Cutter

The illustration shows an adaptation of the bevel-gear cutting machine, designed principally for roughing, made by Gould & Eberhardt, Newark, N. J. This is made with either two or three work spindles, so that either two or three gears can be cut at the same time, depending on their size. These spindles are connected by means of helical gears directly under the blanks being cut, and when using three spindles, bevel gears up to 5⅛ inches in diameter can be handled. By using the two outer spindles only bevel gears up to 10¼ inches can be cut, while if the central spindle alone is used, the machine will cut gears up to 24 inches in diameter.



A Multiple Bevel-gear Cutter

The work table in the design shown can be raised and lowered by means of a worm-wheel sector and worm to secure the proper cutting angle. A dial graduated in minutes is provided, and one complete turn of the crank handle gives one degree, which is verified by a vernier sector on the side of the table.

Putnam 24-inch Planer

The halftone shows a motor-driven 24x24-inch planer built by the Putnam Machine Company, Fitchburg, Mass. The table is heavy, has large pockets at each end and is provided with three T-slots besides the usual reamed bolt holes. The shipper dog has a trip latch permitting the table to pass without changing the position of the dogs. All bearing surfaces are scraped. All shafts, screws, rods, etc., are of steel. All nuts are case-hardened.

The head has a traverse of 10 inches and its screw is provided with a micrometer dial.

The elevating screws have hardened steel points and adjustable steps to preserve accuracy.

The machine is built in various lengths to plane work from 5 to 10 feet long, varying by one foot. It is also built for belt drive.

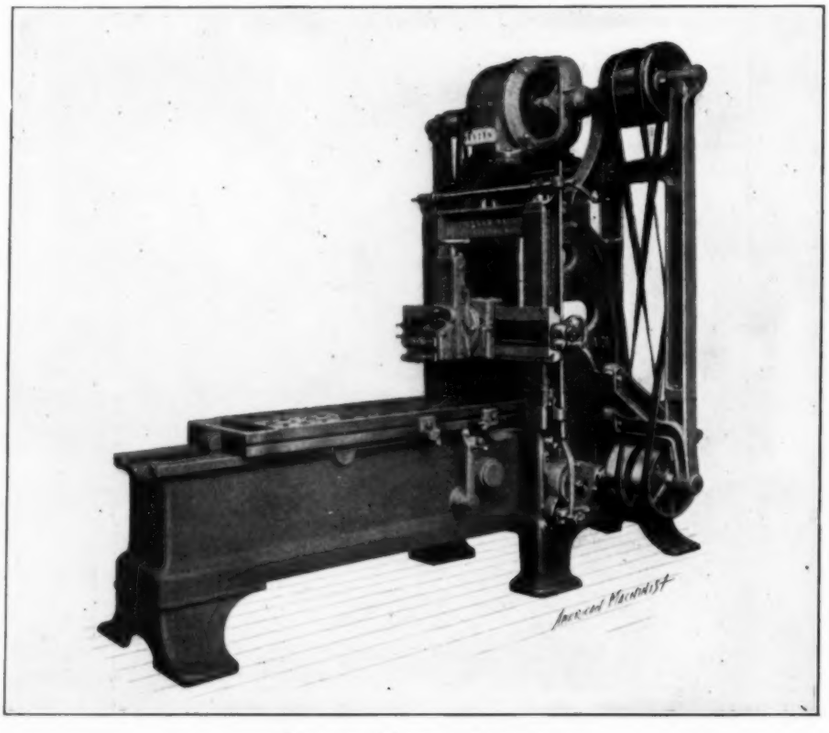
Spiral Gear Cutting on the Pratt & Whitney Thread Milling Machine

The halftone shows the Pratt & Whitney 6x14-inch thread milling machine built by the Pratt & Whitney Company, Hartford, Conn., arranged for the cutting of spiral gears.

The relation between the inner and outer spindle, by means of which indexing is accomplished, is controlled directly by the index plate and index pawl. The index plates are very accurate and much larger in diameter than the gears to be cut, thus, errors such as are apt to result where gearing is used are reduced to the minimum.

The quick return is by a crank located at the front of the machine.

The machine is provided with preci-



Putnam 24-inch Planer

sion lead and cross-feed screws. Micrometer dial and positive adjustable stop give very accurate control of the cutter head.

The cutter is located in a manner to prevent chip interference, which permits exceptionally fast feed without sacrificing the quality of the work.

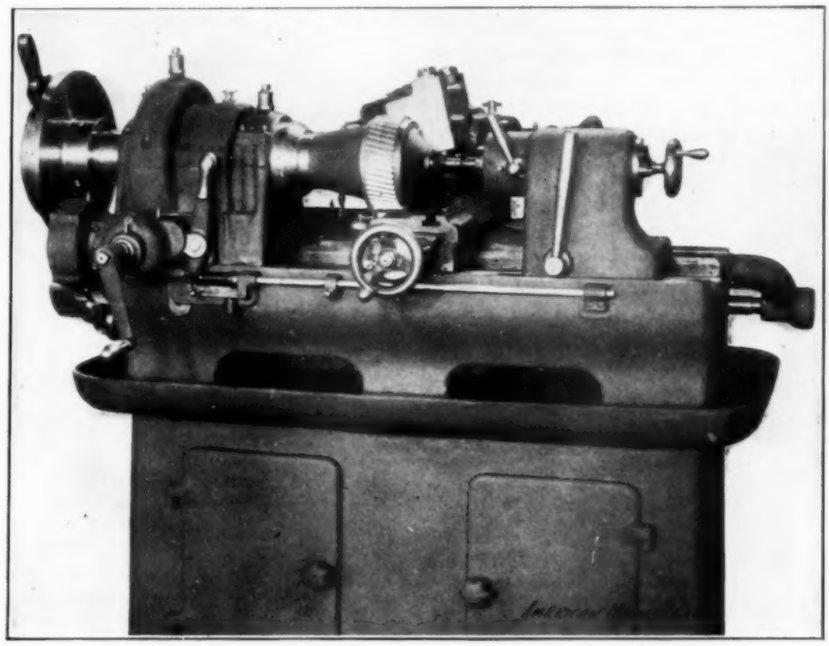
swiveling action for proper cutter clearance is obtained without disturbing the central relation of the cutter and work, accurate graduations being provided for this purpose.

The cutter spindle is provided with a taper hole for the reception of the various cutter arbors and is mounted in the

rately returning it to the exact previous depth.

The cutter is provided with three speeds by means of a three-step cone. Eighteen distinct carriage feeds are instantly obtained for each cutter speed through a gear box.

The attachment, as regularly made, is suitable for the threading of holes from about 1½ to 6 inches in diameter. It is equally well suited for single or multiple threads, either right or left hand. Fig. 2 shows samples of work done with the attachment.



SPIRAL-GEAR CUTTING ON THE PRATT & WHITNEY THREAD MILLER

Three cutter speeds are provided. Eighteen carriage feeds for each speed of the cutter are instantly obtained by means of a geared feed box.

Change gearing and other operating requirements are of the simplest possible nature and are conveniently located and operated to enable one workman to take care of several machines.

An Internal Thread Milling Machine

The halftone, Fig. 1, shows a recently developed attachment for the milling of internal threads on the Pratt & Whitney thread milling machine, built by the Pratt & Whitney Company, Hartford, Conn. This attachment is unusually flexible and efficient.

The cutter head is made a complete unit and may be readily accommodated to the regular carriage. The necessary

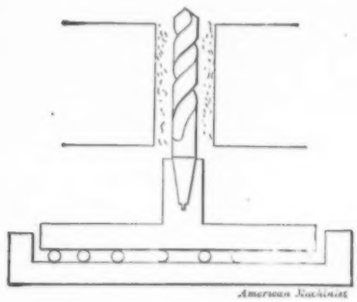
head in a manner to permit the longitudinal adjustment of the spindle.

The cutter spindle is gear driven directly from the main driving shaft.

A simple stop permits the withdrawing of the cutter from the work and accu-

Hardening Twist Drills with Air

The illustration explains the operation of a simple and ingenious device for air-hardening twist drills, reamers, mill-



ARRANGEMENT FOR AIR-HARDENING TWIST DRILLS

ing cutters, end mills, etc., with shanks or arbor-driven tools. This apparatus permits hardening to the highest degree the cutting edges of the tool, leaving the heart comparatively soft and tough.

The apparatus consists of a cast-iron

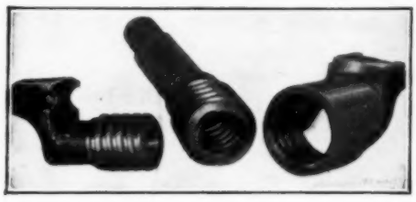


FIG. 2. THE WORK

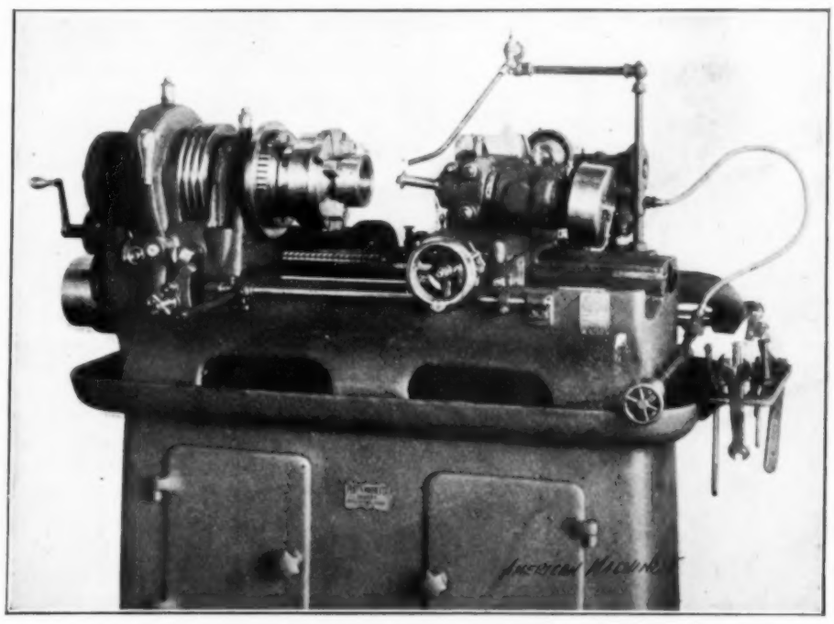


FIG. 1. PRATT & WHITNEY INTERNAL THREAD-MILLING ATTACHMENT

hollow disk about 20 inches in diameter, about 2 inches high at the edge, the inside or clear dimension being about 18 inches in diameter and 1 inch depth. Into this is fitted a cast-iron plate running on ball bearings and revolving easily within the disk. This revolving plate carries a hub adjusted to receive bushings, drilled and reamed so as to receive the various tapers or straight holes to receive tools with taper or straight shanks, also with a solid sleeve to receive arbor-driven tools. These tools should be inserted in the hub with a snug fit.

Two jets of air are brought through flat-nosed pipes about 3/16 inch thick. The width, however, can be regulated according to the length of tool to be hardened. The two nozzles face the cutting edges of the tool, they are not exactly opposite one another but are parallel, the distance between them being adjusted according to the thickness of the tool. The heated tool is inserted in place, the air forced through the nozzles which will cause the tool and with it the circular plate to revolve swiftly on the ball bearing, and the hardening process is accomplished perfectly and uniformly in a few seconds. This is suggested by the New Metal Tool Steel Company, Portland, Maine.

A Metal Sawing Machine

The halftone shows a cold-sawing machine built by the Taylor-May Machine Company, Rochester, N. Y.

The machine is intended for rapid and accurate cutting of the smaller sizes of stock used in factories, and will handle work up to three inches in diameter. A semi-high-speed steel saw is furnished with each machine, but saws made of any particular brand can be supplied.

The spindle is three inches in diameter at the large end. It is pack-hardened and ground and runs in taper bearings adjustable for wear. It is driven through bevel gears and worm and worm wheel from the pulley.

A Metal-sawing Machine

A Bevel Gear Driven Multiple Drill

In the all geared multiple-spindle drill shown in Fig. 1, the substitution of gears for universal joints and the method of adjusting the spindles to any desired position, horizontally or vertically, are the more novel features.

The base has a working surface 30x28 inches.

The power is transmitted from a 2 to 1 variable-speed motor through a 4-inch double belt to a 16-inch pulley.

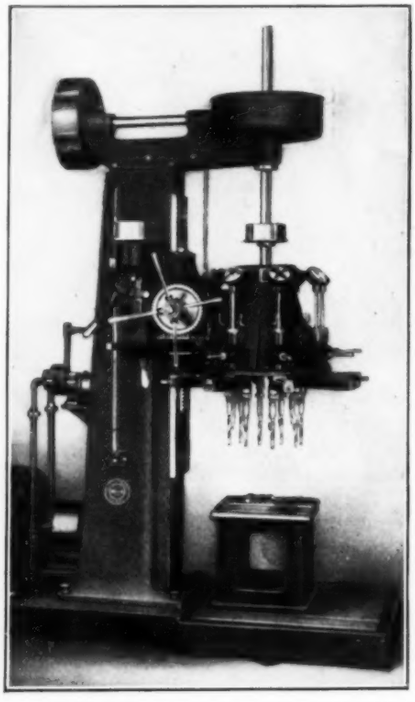


Fig. 1. A Bevel-gear Driven Multiple Drill

The spindle head has a bearing surface on the column 20x9 inches. The method of driving the spindles is clearly shown in Fig. 2, the small bevel gears being of chrome-nickel steel, hardened and incased, thus permitting them to run in lubricant.

The vertical adjustment of the drill socket in the spindle is by means of a pin a tight fit in the drill socket but sliding in an elongated slot in the spindle. The ends of the pin engage a recess in the nut fitted to the external thread on the end of the spindle, giving an adjustment of 1½ inches in each spindle.

The drill head has power feed through a geared feed box giving three mechanical quick changes by hand lever. The feed may be thrown in or out by a hand lever and positive clutch or automatically tripped at any desired point; for quick traverse of the drill head in either direction a large pilot wheel is used, engaging the pinion shaft and rack by means of a tooth clutch.

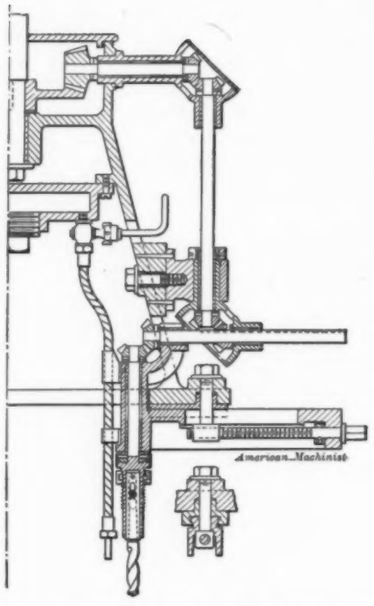


Fig. 2. Details of the Method of Driving the Spindles

The capacity of the machine illustrated is ¼- to ½-inch high-speed drills within a 12-inch and outside a 4½-inch circle; the least center distance between spindles 1¾ inches. Other standard sizes are furnished with four, six, ten and twelve spindles, suitable for drilling 1-inch holes, the largest inside of a 24-inch circle, and outside of a 9-inch circle. Also a standard head for twelve and sixteen ½-inch holes in a rectangular surface 16 inches by 20 inches.

The box table is 16 inches square by 16 inches high.

This machine is manufactured and sold by the Walter H. Foster Company, 50 Church street, New York.

Modeling wax is used by diesinkers for obtaining impressions of their work while in progress or when completed. It can usually be bought from dealers in artists' materials, but it is also very easily made in the following manner. Take 1000 parts of yellow wax; 130 parts of Venice turpentine; lard, 65 parts; bole, 725 parts. Heat the ingredients slightly and mix thoroughly, while the mixture is still liquid pour it into tepid water and knead it well with the hands until a plastic mass is obtained. Wet the work with the tongue or with soapy water, before taking an impression with the wax, as otherwise it will be found that the wax will cling to the work.

Is the Bronze Box a Good or a Bad Thing?

By John E. Sweet

With one or perhaps two or three exceptions, the machine-tool builders use bronze boxes and boast about it in their advertisements. Do they do it because they have proved them "the best ever" or is it that they have found them a selling point?

The story is told that the Pratt & Whitney Company once put in a new engine with a bronze crank box, which got cutting as they about all do. They at once ordered a new one but, not being in shape to wait for it, babbitted up the old box and went ahead. When the new bronze box arrived they laid it on the shelf ready to put in when the babbitt box gave out, and it was there seventeen years later. So Pratt & Whitney profited by the lesson and use babbitted boxes. Wm. Sellers & Co. use cast-iron boxes for line shafts hangers and exhibited a specimen at the Massachusetts fair in Boston that had been in use for 62 years and in that time the shaft had made many millions of turns and the box showed practically no wear.

If cast-iron boxes are mentioned for machine tools the reply is that they would be all right if never allowed to get dry. Why should the journals of a machine tool be allowed to run dry more than a lineshaft, and who by experiment has proved that a dry bronze box is better than a dry cast-iron one?

The late C. E. Lipe, who built milling machines of which there are a number running, put in cast-iron boxes and, so far as I can find out, no one has ever had any trouble or had to take up wear to any extent. He used cast-iron boxes almost exclusively in his machinery and babbitt boxes otherwise.

This question of what will sell often comes up and machine-tool builders make more of a bugbear out of it than is justified I guess.

If you have been bragging about your bronze boxes and put in cast iron which is likely ten times better, don't brag about it Put them in and if, in ten or twenty-five years the buyer finds out about it and they have given better service than he ever dreamed of, he is not likely to bother the maker, nor ask any questions as to substitution.

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

Metal Working

NEW ENGLAND

Lonergan & Moore, Attleboro, Mass., will start a jewelry factory.

Workman & Newman, jewelers, Providence, R. I., will erect a factory.

The Spencer Wire Company, Worcester, Mass., will erect an addition.

The Murray Company, Providence, R. I., is in the market for a power press.

The Hunt Metal Corner Company, Westboro, Mass., is to erect a new factory.

The Winchester Repeating Arms Company, New Haven, Conn., will erect an addition.

The Elliott Addressing Machine Company will build a new factory in Cambridge, Mass.

The Arcade Malleable Iron Company, Worcester, Mass., will build an addition to its foundry.

Alderman & White, Suffield, Mass., are to erect an automobile garage. Equipment will be needed.

The American Warp Drawing Machine Company is building a new factory in Dorchester, Mass.

The Bonney Car Fender Company, Rockland, Mass., has leased more floor space, and will equip same.

The Arcade Malleable Iron Company, Worcester, Mass., is altering its building on Albany street to be used as a foundry.

The Lamson Consolidated Store Service Company, Lowell, Mass., is in the market for machine tools, including lathes, milling machines, planers, etc.

Plans have been completed for a new fire-department repair shop to be erected at Bristol and Albany streets, Boston, Mass. This is to cost $95,000.

Proposals will be received until 11 a.m., February 10, by the commanding officer at the Watertown (Mass.) Arsenal for furnishing and installing an open-hearth furnace. Specifications can be had of the commanding officer.

MIDDLE STATES

Colgate & Co., Jersey City, N. J., will erect a garage.

F. Schreiber, Zanesville, Ohio, will build a new tin shop.

The Rampo Iron Works, Hillburn, N. Y., will erect a switch shop.

The Seager Engine Works, Lansing, Mich., is planning to extend its plant.

The Union Metal Manufacturing Company will erect a plant in Canton, Ohio.

The Golden Rule Hay Press Company, Kalamazoo, Mich., will erect a plant.

The Power and Mining Machinery Company, Cudahy, Wis., is to build several additions.

The Battle Creek (Mich.) Engine Company will erect a three-story plant to cost $100,000.

The Monitor Boat and Engine Company, Newark, N. J., is seeking site for a new plant.

The E. M. F. Auto Company, Detroit, Mich., is to build an addition to its plant on Clark street.

The Superior Auto Company, 912 Ogden avenue, Superior, Wis., will erect a two-story garage.

The Jones Iron Furnace, Iron Mountain, Mich., is looking for site for a new rolling mill, etc.

The Rock Falls (Ill.) Manufacturing Company will increase the capacity of its machine shop.

The Federal Motor Company, Buffalo, N. Y., will erect a factory for the manufacture of motor trucks.

The Continental Motor Manufacturing Company, Muskegon, Mich., will erect a four-story factory.

The Houghton Elevator and Machine Company, Toledo, Ohio, will erect a new factory on Erie street.

The Apperson Automobile Company, Kokomo, Ind., is looking for site for a new and larger plant.

The Independent Bridge Company, Pittsburg, Penn., is said to be planning the removal of its plant.

The Excelsior Steel Furnace Company, of Chicago, Ill., will establish a branch factory at Des Moines, Iowa.

The Kelly Reamer Company, Cleveland, Ohio, it is said, contemplates adding to its machine-tool equipment.

The Marine Boiler Works, Toledo, Ohio, will erect an addition to its plant. Will also build stationary boilers.

It is said the Hydraulic Press Manufacturing Company, of Mount Gilead, Ohio, is considering the removal of its plant.

The New York Motorboat Company's factory, 519 City Island avenue, City Island, N. Y., was burned, entailing a heavy loss.

The Parkersburg (W. Va.) Iron and Steel Company has commenced the erection of a large addition to its plant at Beechwood.

The Chicago (Ill.) Pneumatic Tool Company is said to be considering the establishment of a branch factory in the Central West.

The American Stamping Company, of Mendon, Mich., is looking for site for a plant for the manufacture of grease and oil cups.

The Pennsylvania Motor Car Company, recently organized, will erect a plant in Philadelphia, Penn., for the manufacture of motor trucks.

The Christiansen Engineering Company, Milwaukee, Wis., manufacturing gasolene engines, compressors, etc., will erect a new shop building.

The Finlayson Heater Company, Detroit, Mich., is considering site in the Central West for a new plant for the manufacture of hot-water furnaces.

The Ohio Corrugated Culvert Company, of Middletown, Ohio, has increased its capital from $65,000 to $100,000 to provide for extensive improvements.

The Great Lakes Manufacturing Company, North Chicago, Ill., will rebuild its plant recently burned. The company manufactures hardware specialties.

The Hyde Metal Boat Company, Watertown, N. Y., having outgrown its present quarters, is said to be looking for suitable site for a larger plant.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids January 31 for 15 pneumatic drilling machines (schedule 3273).

The Nye Company, Buffalo, N. Y., has been incorporated to manufacture engines, machinery, etc. Capital, $10,000. Incorporators, Geo. B. Nye, Walter Devereux, Wm. Palmer.

The Gary Iron and Steel Company, Niles, Ohio, has plans prepared for the erection of a puddle mill that will consist of six double furnaces and muck rolls and "break-down" mill.

The Backus Novelty Company, Smethport, Penn., has appropriated $15,000 for an addition to its plant and is in the market for grinders, die punch presses and milling machines.

The Advance Auto and Machine Company, Evansville, Ind., has been organized to manufacture automobiles. Capital, $10,000. Incorporators, Henry Kolker, Walter Wheeler, John Diers.

The Gray, Hawley Manufacturing Company, Detroit, Mich., will erect a new factory on Jefferson avenue, near McDougall. The company manufactures brass specialties for motor boats and motor cars.

The Wrought Iron Castings Company, New York, has been incorporated to manufacture wrought-iron castings. Capital, $50,000. Incorporators, A. A. Buehring, Wm. E. Volz, 126 Liberty street, etc.

The F. & F. Felger Company, Newark, N. J., has been incorporated with $125,000 capital to manufacture jewelry, silverware, etc. Incorporators, Fred F. Felger, Jr., F. H. Felger, F. C. D. Bonnor.

Great Western Transportation Company, Chicago, Ill., has been incorporated to manufacture automobile freighting trucks. Capital, $100,000. Incorporators, S. B. Geiger, W. M. Trout, H. M. Wilcox.

The Dressler Manufacturing Company, New York, has been incorporated to manufacture scientific and surgical instruments. Capital, $200,000. Incorporators, C. E. Dressler, W. E. Malone, N. A. Smyth.

The Seaton Spring Wheel Company, Indianapolis, Ind., has been incorporated to manufacture wheels, tires and automobile parts. Capital, $10,000. Incorporators, W. B. Cooley, W. H. Nusbaum, B. C. Seaton.

The Detroit Delaware Manufacturing Company, Hammond block, Detroit, Mich., is in the market for a line of power presses and other machine tools for the manufacture of an attachment for sewing machines.

The Marcus Bridge and Iron Works, Peoria, Ill., has been organized with $50,000 capital to manufacture structural and ornamental iron and steel work. Incorporators, James V. Marcus, John J. Marcus, K. Marcus.

The Success Pressed Steel Slat Company, New Orleans, La., has been organized with $750,000 capital to manufacture a patented steel slat. Directors are Henry W. Hillie, W. J. Turnbull, Jr., Leon Levedan, etc.

The Avery Company, Cleveland, Ohio, has been organized with $150,000 capital to manufacture and sell pressed metal, dies and machinery of all kinds. Incorporators, Alonzo M. Snyder, N. J. Young, W. J. Budd, etc.

The Alumerloyd Products Company, Canton, Ohio, has been formed with a capital of $25,000, to manufacture and sell sheet metal, castings, forgings and machinery, by R. A. Barthelomew, David D. Day, Austin Lynch, etc.

Anthracite Auto Company, Cleveland, Ohio, has been incorporated with $10,000 capital to manufacture, assemble and handle steam engines and motor vehicles. Incorporators, Sidney Seidman, Henry White, James A. Joyce, etc.

Farrell, Kemp & Gushe Company, Joliet, Ill., has incorporated to engage in general sheet-metal work, furnace heating and hardware business. Capital, $12,000. Incorporators, Clayton S. Farrell, Wm. B. Kemp, Henry C. Gushe.

The Wilson Taxicab and Motor Car Company, Syracuse, N. Y., has been incorporated with $10,000 capital to manufacture, repair, rent and deal in automobiles, etc. Incorporators, S. H. Wilson, Geo. F. Haas, R. [illegible] Byrne.

The Peterson-Brown Company, Mansfield, Ohio, has been organized to manufacture and sell locks, metal stampings, woodworking machinery, by John F. Peterson, Edward N. Brown, William A. Schuster, etc. Capital, $20,000.

The Tri-Eye Hook and Eye Company, New York, has been incorporated to manufacture hooks and eyes, etc. Capital, $100,000. Incorporators, Jas. Hippisley, 226 West Eleventh street; C. W. Bliss, E. M. Kolstad, 170 Broadway, New York.

The Delaware & Hudson Railroad Company has applied for permission to issue $7,000,000 bonds, part of which will be applied for new shops at Watervliet, N. Y., which will include locomotive repair shop, blacksmith shop, boiler and tank shop, etc.

The American Abrasive Metals Company, New York, has been organized to manufacture and deal in hardware machinery, mill supplies, etc. Capital, $100,000. Incorporators, W. H. Sayre, W. M. Beard, Glen Ridge, N. J.; A. D. Morris, New York.

Mebane Manufacturing Company, Cleveland, Ohio, has been organized to manufacture and sell brass forgings, machinery and stampings. Incorporators, F. M. Fielding, C. P. Mebane, C. E. Wonders, W. E. Weaver and A. B. Lindsay. Capital, $10,000.

Bishop & Babcock, owners of the Cleveland Manufacturing Company and the Cleveland Tack Works, manufacturing brass faucets, tacks, nails, etc., are making investigation in the southern section with a view toward securing suitable site for a new factory.

J. H. Louis Automobile Company, Cincinnati, Ohio, has been incorporated to manufacture and sell automobiles, parts and accessories. Capital, $75,000. Incorporators, J. H. Louis, Peter Leiter, M. Y. Chenol, Thomas S. Danks and Edward G. Schultz.

Owing to increasing pressure of business, the Remington Typewriter Works, Ilion, N. Y., will largely increase its capacity by the erection of a new Administration building, which, when completed, will make all of the factory floor space available for manufacturing, and will clear the way to further additions, which are being planned.

SOUTHERN STATES

Charles Webster & Co. will erect a can factory at East Newmarket, Md.

The Sanford Foundry and Stove Company, Knoxville, Tenn., will build a new plant.

The Isherwood Chandelier and Manufacturing Company, Birmingham, Ala., has been incorporated to manufacture fixtures, motors, fans, etc. Capital, $10,000. W. S. Isherwood, president.

The Clark Gear Company, Elkins, W. Va., has been incorporated to manufacture Clark automatic reverse gear and gears of all kinds. Capital, $20,000. Incorporators, P. E. Clark, M. Clark, R. Chaffee, etc.

WEST OF THE MISSISSIPPI

P. Peterson, of Erskine, Minn., will erect a blacksmith shop.

The "Soo line" may build a roundhouse at Burlington, N. D.

The Block blacksmith shop, at Buffalo, Minn., was burned.

The Duluth (Minn.) Iron and Metal Company is looking for site for a branch plant.

The building of the Keystone Automobile Company, Seattle, Wash., was destroyed by fire.

The Vulcan Iron Works, Seattle, Wash., will install new equipment in its structural shop.

Wood Brothers' Self Feeder Company will build an addition to its plant at Des Moines, Iowa.

G. O. Guy, Seattle, Wash., will build a machine shop. Modern equipment will be installed.

The Van Ness Company, San Francisco, Cal., is building an addition to its garage and repair shop.

The Otis Elevator Company, Portland, Ore., is contemplating the erection of a three-story factory building.

The Great Northern Railroad will build a shop for small repairs on its new property, at Gold Bar, Wash.

W. W. Fisher, Los Angeles, Cal., will build a commercial garage and repair shop. Modern equipment will be installed.

K. S. Cashin, Fresno, Cal., will build a garage and machine shop to cost $10,000. Modern equipment will be installed.

The Cizek Sheet Metal Works, Tacoma, Wash., will increase the capacity of its plant. The company manufactures a patent sash.

The Forve-Pettebone Company, Los Angeles, Cal., manufacturers of lighting fixtures, will establish a factory at Tenth and Santee streets.

The Woods Motor and Taxicab Company, Victoria, B. C., will build a commercial garage and repair shop. Modern equipment will be installed.

The Calvin-Crawford Company has been incorporated at Tacoma, Wash., to manufacture aëroplanes after patents issued to W. E. & G. Calvin.

The Idaho Industrial Training School, St. Anthony, Ida., contemplates the erection of a new manual training shop. Modern equipment will be installed.

The city of Stockton, Cal., is contemplating the addition of a mechanical arts department at the city high school. J. H. Francis, superintendent of schools.

The Pacific Gas and Electric Company, Oakland, Cal., has taken out a permit to erect a garage and repair shop. Modern repair machinery will be installed.

The Mathewson Aëroplane Company, Denver, Colo., has been incorporated with $50,000 capital by E. Linn Mathewson, Geo. W. Thompson, Garret Van Arsdale.

The Mexican Iron and Steel Company, Boston, Mass., operating in Jalisco, Mexico, is contemplating the erection of a steel plant and tool works addition to its plant.

The United States Cashier Company, Fulton, Ore., is contemplating the erection of a new factory in the vicinity of Montavilla; a tool shop will be included in the plant.

The Swanson Manufacturing Company, of Shenandoah, Iowa, has reorganized in Illinois and will locate in Marseilles, Ill. The company manufactures farm implements and street sweepers.

The Northern Welding and Manufacturing Company, of Minneapolis, Minn., will erect a new one-story repair shop on University avenue and Washington street, southeast, Minneapolis, Minn.

The A. D. Cook Company, railroad contractor, is building a large plant at Wayne, Mont. Machine and blacksmith shops will be thoroughly equipped; an electric-light plant and water-supply system will be installed. This will be the company's headquarters.

CANADA

The Fairbanks-Morse Company has taken out permits for a new $13,000 foundry and foundry cleaning and pattern room, at 1363-1369 Bloor street, west, Toronto, Canada.

General Manufacturing

NEW ENGLAND

The Cutler Mills, Warren, R. I., will build an addition.

Henderson Brothers, Cambridge, Mass., will install a steam boiler.

The laundry of G. McDonald, East Deering, Me., was destroyed by fire.

The city of Taunton (Mass.) contemplates installing a filtering system.

The Ideal Switch Company, Plainville, Conn., will erect a new factory.

The Crocker-Burbank Company, Fitchburg, Mass., will install a steam boiler.

Armour & Co. are taking bids for a refrigeration warehouse at Stamford, Conn.

The plant of the Perkins Box Company, Gloucester, Mass., was destroyed by fire.

The Barrington Mills, Great Barrington, Mass., contemplates extensive alterations.

The Meshaum Knitting Mills, New Bedford, Mass., is to install new equipment.

The Alfred Kimball Shoe Company, Haverhill, Mass., will install a steam-engine plant.

The town of Marblehead, Mass., will install a 2,000,000-gallon high-duty pumping engine.

The Saxony Worsted Mills, Newton, Mass., contemplates large addition with new equipment.

The Providence (R. I.) Brewing Company plans to expend $30,000 on additions to its plant.

The Charlton Mills, Fall River, Mass., is in the market for boiler equipment for a new plant.

The Ridgefield (Conn.) Electric Light Company will install a new electric-generating plant.

The Rhode Island Coöperative Coal Company, Providence, R. I., will install a steam boiler.

Fire destroyed the mills of the Penrhyn Slate Company, at Hydeville, Vt. Loss, $12,000.

Roundhouse of the Iowa Central Railroad at Marshalltown, Iowa, was burned. Loss, $100,000.

The Lubec Sardine Company, Belfast, Me., is considering installing a 60-kilowatt electric plant.

The International Rubber Company, West Barrington, R. I., is making additions to its power plant.

L. B. Dow, 176 Federal street, Boston, Mass., is in the market for an 11x15 center-crank engine.

The candy factory of Aldrich-Cliskee Company, Boston, Mass., was destroyed by fire. Loss, $55,000.

Plans are being drawn for additions to the spinning plant of the Manomet mills, New Bedford, Mass.

The New York, New Haven & Hartford Railroad is erecting a new power house at Adams, Mass.

The Lehigh Valley Silk Company, of South Bethlehem, Penn., will locate a branch at Westerly, R. I.

The sporting-goods factory of Draper & Maynard, at Plymouth, N. H., was burned. Loss, $100,000.

The Collins-Plass Company, Fall River, Mass., is having a three-story addition erected to its bag factory.

The factory of G. W. Sammett & Co., Boston, Mass., mattress manufacturers, was badly damaged by fire.

The Draper & Maynard sporting-goods factory, at Plymouth, N. H., was destroyed by fire. Loss, $200,000.

The plant of the Rosemont Dyeing Company, Woonsocket, R. I., was damaged by fire to the extent of $40,000.

Bevin Brothers Manufacturing Company, East Hampton, Conn., will install a hydro-electric plant at Skinnerville, Conn.

The Ponemah Mills, Taftville, Conn., is to have two stories added to its present factory. New equipment will be installed.

The Weymouth Electric Light and Power Company, Weymouth, Mass., will install a steam turbine electric generating unit.

Wm. J. Dunn, dealer in mill machinery, Fall River, Mass., proposes to establish a fine cotton-goods plant at North Tiverton.

The Lowell Rendering Company, South Lowell, Mass., anticipates the installation of a 300-kilowatt generator in the near future.

The Connecticut Company will install a 400-kilowatt generator and other electrical apparatus in its power house at New Haven, Conn.

The Williams Sealing Corporation, Waterbury, Conn., manufacturing jar and bottle caps, is in the market for additional equipment.

The Standard Broom Company, Providence, R. I., with a capital of $100,000, is to locate a factory in that city. Jacob Silverman, director.

The Columbia Baby Carriage and Rattan Company has leased a two-story factory at Fitchburg, Mass., and will commence manufacturing.

The Shambow Shuttle Company, Woonsocket, R. I., is contemplating additions to its plant, including a two-story mill, boiler house and drying house.

The Fletcher Manufacturing Company, Providence, R. I., will erect a two-story addition and install machinery for the manufacture of narrow cotton webbing.

MIDDLE STATES

An electric-light plant is to be installed at New Lisbon, Wis.

New Lisbon, Wis., will establish a municipal lighting plant.

Anthony Mosher & Son will erect a carriage factory at Albany, N. Y.

The Alpha Silk Company is building a new silk mill at Alpha, N. J.

The Pure Carbon Company, Wellsville, N. Y., will erect a factory.

The Buffalo Cereal Company is building a new plant in Buffalo, N. Y.

The Rock Island (Ill.) Sash and Door Works, will erect new shops.

The Beverwyck Brewing Company will erect a bottling house at Albany, N. Y.

The plant of the Diamond Match Company, at Oswego, N. Y., is to be enlarged.

The Didier March Company will enlarge its clay-working plant at Perth Amboy, N. J.

J. Wesley Allison, Morrisburg, N. Y., is in the market for much water-power machinery.

The plant of the Thomas Produce Company, at Merrell, Wis., was destroyed by fire.

The Passaic (N. J.) Worsted Spinning Company is erecting a new factory and power plant.

The Chrisfield Light and Power Company, of Bridgeville, Del., will erect a new gas plant.

The Lackawanna Cold Storage Company, Scranton, Penn., will erect a seven-story plant.

The M. & S. Cocoa and Chocolate Company, Jersey City, N. J., will erect a new plant.

The Arctic Ice Cream Company, Detroit, Mich., will erect a creamery and cold-storage plant.

The Detroit (Mich.) Sulphite Fiber and Paper Company will erect a two-story addition.

The Riley Shoe Manufacturing Company, Columbus, Ohio, will build an addition to its plant.

The Oriental Silk Printing Company, Haledon, N. J., will instal a new engine and boiler.

The Wolverine Pearl Button Company, Grand Rapids, Mich., will erect a three-story factory.

The Buckeye Ice and Coal Company, Findley, Ohio, is contemplating the erection of an ice plant.

The Electric Smelting and Aluminum Company is building a large plant at Perth Amboy, N. J.

J. W. McDonald, Rock Falls, Ill., will move his trimming shop to a new location and add new equipment.

The Terry & Tench Company, contractors, New York, will move to a larger plant in Bayonne, N. J.

The Kenton (Ohio) Gas and Electric Company is contemplating building a new plant to cost $60,000.

The Bloomer (Wis.) Electric Light and Power Company, recently incorporated, will install a plant.

The power house of the Jonathan Creek Coal Company, at Zanesville, Ohio, was burned. Loss, $15,000.

The General Fire Extinguisher Company, Youngstown, Ohio, has let contract for an addition to its plant.

The Rubber and Celluloid Harness Trimming Company, Newark, N. J., will build a large addition to its plant.

The Falcon Manufacturing Company, Big Rapids, Mich., manufacturing woodenware, will erect a new factory.

Minetto-Meriden Shade Cloth Company, Minetto, N. Y., will erect a cotton mill. Electric drive will be installed.

The Sheboygan Evaporated Milk Company will erect a two-story addition to its condensing plant, at Jefferson, Wis.

Benj. Douglas, Ford building, Detroit, Mich., desires estimates on steam or electrical power plant to be erected near there.

The Majestic Furniture Company, of Herkimer, N. Y., is said to be looking for suitable site for a new desk factory.

The John Strootman Shoe Company, Buffalo, N. Y., is erecting a new four-story factory at Monroe and Genesee streets.

The Lake Side Dye Works will erect a $4000 building and factory at Brady street and Farwell avenue, Milwaukee, Wis.

The Schultz-Ruck Delf Shoe Company is to erect a four-story plant at Clark avenue and North Fourth street, Cleveland, Ohio.

The city council, Escanaba, Mich., has authorized the board of public works to have plans prepared for a municipal gas plant.

L. Sterling & O. C. Davidson, of Iron Mountain, Mich., are interested in the erection of a hydroelectric plant on the Menominee river.

Contract has been let by the New York & Ontario Power Company, for the erection of a 15,000-horsepower plant, at Waddington, N. Y.

The tanneries of Albert Trostel & Son Company, of Milwaukee, Wis., recently destroyed by fire, are to be replaced by a six-story building.

The Sussex Light and Power Company has succeeded the Laurel-Seaford Electric Light Company, at Laurel, Del., and is enlarging its plant.

The Rubberset Company has purchased a factory building on Ferry street, Newark, which it will use for the manufacture of raw material.

Proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until 11 a.m., February 4, for a 60-ton traveling crane for the Norfolk, Va., navy yard.

The Public Service Commission has authorized the Syracuse (N. Y.) Rapid Transit Company to issue $1,750,000 of new preferred stock; $90,000 will be spent this year on improvements.

Fire did $15,000 damage to the plant of the Charles L. Jordan Paper Box Manufacturing Company, Syracuse, N. Y., and much damage to the plant of the Wood Glass Company, of the same city.

The Barnesville Bottle Company, Barnesville, Ohio, has been organized to manufacture and sell bottles and glassware. Incorporators, D. M. Dorsey, F. E. Wooster, William M. Bricker, etc. Capital, $30,000.

The Chemical Fire Extinguisher Company, Cleveland, Ohio, has been incorporated with $20,000 capital to manufacture and sell fire extinguishers. Incorporators, Charles A. Burke, J. A. Burke, Charles A. Aaron, etc.

The Brown Dye House, Columbus, Ohio, has been incorporated with a capital of $20,000 to engage in the dyeing and dry-cleaning business. Incorporators, Sherman D. Brown, W. T. Morgan, D. B. Ulrey, etc.

Proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until 11 a.m., February 11, for six oil tanks with pumps, meters, gages, piping, etc., for the Portsmouth, N. H., navy yard.

The Reinforced Tile Roof Company, Youngstown, Ohio, has been organized to manufacture and sell clay products, especially tile roofing. Incorporators, John P. Young, Albert A. Lane, Henry M. Caldwell, etc. Capital, $50,000.

The Isthmian Canal Commission, Washington, D. C., will receive bids up to 10:30 a.m., March 30, for furnishing and erecting three pairs of emergency dams at the upper locks of Gatun, Pedro and Miraflores; also tools, equipment, etc., as per Circular No. 616.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids January 31, for pipe fittings, unions, composition gate valves, brass gate valves, brass globe, angle and check valves (schedule 3266), copper tubing (schedule 3264).

Proposals will be received until 10 a.m., February 14, by the Department of Justice, Superintendent of Prisons, Washington, D. C., for electric-light and power installation at the United States penitentiary, Atlanta, Ga. Specifications can be had of R. V. Ladow, superintendent of prisons.

Proposals will be received until 10 a.m., February 16, by the Department of Justice, Superintendent of Prisons, Washington, D. C., for installing electric-light and power equipment at the United States penitentiary, Leavenworth, Kan. Specifications can be had of R. V. Ladow, Superintendent of Prisons.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will receive bids January 31 as follows: One induction motor (schedule 3268), three motors (schedule 3259), electrical supplies (schedule 3261), steel bolts and nuts (schedule 3265), emery cloth, reamers, rivets, brass wood screws, hand tools (schedule 3273), bar steel, cold-rolled bar steel, medium bar steel, rivet steel (schedule 3272).

SOUTHERN STATES

The Armour Packing Company will erect a plant at Ridgway, Md.

The Empire Chair Company, Elizabethtown, Tenn., contemplates installing motors.

The Davidson Chemical Works, Curtis Bay, Md., has plans for three additional buildings.

The Roanoke (Va.) Railway and Electric Company will install a 2000-kilowatt turbine.

The Jefferson-Holt Ice Company, Federalsburg, Md., will double the capacity of its plant.

The Salisbury (Md.) Light, Heat and Power Company intends to install new electrical equipment.

The Easton (Md.) Light and Fuel Company is to erect a new station to be equipped with boilers and electrical equipment.

The W. & J. Knox Net and Twine Company will erect a large addition to its plant, at Johnson and Barney streets, South Baltimore, Md.

The Skinner Bending Company, of Kenova, W. Va., is desirous of securing a suitable location for a plant for the manufacture of wheel rims, etc.

WEST OF THE MISSISSIPPI

Charles Bliss, of Dent, Minn., will build a box factory.

Redkey, Ind., is to have an electric-light and power plant.

F. J. Moore will build a wood-pulp factory at Hoquiam, Wash.

Britton, Okla., will construct waterworks at a cost of $30,000.

The Independent Oil Company will build a plant at Chehalis, Wash.

The Omaha Dye Works, of Omaha, Neb., will erect a $10,000 plant.

Hoisington, Kan., has issued bonds for the construction of waterworks.

William Hicks, Elwood, Ind., will enlarge his hardwood lumber plant.

Helena, Mont., voted $650,000 bonds for municipal waterworks plant.

Joseph Ault's sawmill, at Clear River, Minn., was destroyed by fire.

The Waterloo (Iowa) Chemical Company will erect a three-story plant.

J. J. Chalupink and John Berau, of Verdigris, Neb., will erect a creamery.

The Sioux City (Iowa) Packing Company sustained a loss of $10,000 by fire.

J. I. Moore, of Minot, N. D., will install an electric-light plant at Stanley, N. D.

B. W. Ultman, of Hudson, Wis., will erect a power plant on the Kinnickinic river.

The Michigan Furniture Company, Tacoma, Wash., will build an addition to its factory.

R. A. Brown, Gaston, Ind., is preparing to install an electric-lighting and power plant.

The A. R. Flick Box Company, Dubuque, Iowa, will rebuild its plant recently burned.

The city council, Hamilton, Iowa, is considering the construction of a pumping plant.

The city of Freewater, Ore., will install a municipal water system to cost about $16,000.

The C. Shenkberg Candy Company's plant at Sioux City, Iowa, was destroyed by fire.

The citizens of Tower, Minn., will vote on the issuance of bonds for building a power plant.

The Great Northern Railroad will double the capacity of its ice plant at Hillyard, Wash.

The Rieflin Sash and Door Company, Tacoma, Wash., will double the capacity of its factory.

A. J. Hartman, Brandon, Ore., will build a box factory. Modern equipment will be installed.

E. M. Larson, Riverside, Cal., is planning for extensive irrigation operations in this section.

The California Fruit and Syrup Company, Oakland, Cal., has taken out a permit to erect a factory.

Joseph Rice, Orenco, Ore., will establish a tile and brick plant. Modern equipment will be installed.

Paul Bettelheim, Springfield, Ore., is contemplating the erection of a match factory at Eugene, Ore.

R. E. Porterfield, of Troy, Mont., has been granted a franchise to install an electric-light system there.

The county supervisors, San Francisco, Cal., will expend $1,125,000 in the city's Sierra water system.

W. Ehrlickson, Ellensburg, Wash., is contemplating the erection of a soap factory at Tacoma, Wash.

E. F. Glaze, of the Goliad (Tex.) Water and Light Company, has plans for the erection of an ice plant.

The Duarte Mutual Irrigation Company, Monrovia, Cal., will install two high-power pumping plants.

Thirteen thousand dollars will be spent on improvements at the Rushville, Ind., water and light plant.

The city of Silverton, Ore., contemplates the installation of a municipal water and sewerage system.

The Pacific States Telephone and Telegraph Company, Eugene, Ore., is planning to rebuild its entire system.

The Inland Empire Paper Mill Company, Spokane, Wash. (W. S. Yearsley, president), will build a plant.

A. G. Simpson, Chico, Cal., is planning for the erection of a power plant on Deer creek, near Red Bluff, Cal.

Louis P. Larson will erect an electric-light plant and waterworks, at Metalline Falls, near Colville, Wash.

The Huntington Beach Company, Hunting-

ton Beach, Cal., will install an irrigation system in this section.

The Peerless Laundry, Evansville, Ind., has been incorporated with $10,000 by D. S. Bernstein, Hiram Paul, etc.

A. Morin, Conconully, Wash., will build a modern laundry in this city. Uptodate equipment will be installed.

The Shawnee (Okla.) Development Company has arranged to organize a $250,000 company to build a cotton mill.

John Dierks and G. L. Lyons, Twodot, Mont., are building a cement factory. Modern equipment will be installed.

Bids will be received sometimes in February, at Huron, S. D., on a pumping plant of 2,000,000 gallons daily capacity.

The city of Falls City, Ore., will install a municipal water system to cost $25,000. Bonds for this sum will be voted.

G. C. Martin, Pasadena, Cal., is at the head of an enterprise to build an electric railroad to Mount Wilson, in this vicinity.

The Acorn Brick and Tile Company, of Albert Lea, Minn., will erect a large factory at Glenville, Minn., in the spring.

The grain mill of the Dauser Mill Company, Anaheim, Cal., was destroyed by fire. The plant will be immediately rebuilt.

R. E. Porterfield, Libby, Mont., has been granted a franchise for waterworks system and electric lighting at Troy, Mont.

The plant of the General Electric Company, at Minneapolis, Minn., recently burned, will be rebuilt at a cost of $750,000.

James M. Grigsby, Banning, Cal., is planning for extensive irrigation work in this vicinity. Equipment will be required.

L. D. Pugsley, president of the First State Bank, at Chester, Mont., has petitioned the council for an electric-light franchise.

The Pacific Light and Power Company, Walla Walla, Wash., will improve its distribution system to the extent of $8000.

The pumping plant of the C. C. Harris Oil Company, Los Angeles, Cal., was destroyed by fire. New equipment will be installed.

The Pacific Tank and Pipe Company, Kenton (Portland), Ore., is contemplating the erection of a sawmill addition to its plant.

The California Fruit Canneries Association, Klamath Falls, Ore., is contemplating the erection of a lumber mill and box factory.

The Walla Walla Meat and Cold Storage Company, Walla Walla, Wash., will enlarge its plant; $20,00 will be expended on improvements.

The Mutual Shingle Company, Marysville, Wash., is having plans prepared for a shingle mill to cost $30,000. Modern machinery will be installed.

W. F. Holt, Calexico, Cal., will build a new steam plant at El Centro, Cal. It will be of 120 horsepower capacity. About $25,000 will be expended.

The Whidby Island Light and Power Company, Coupeville, Wash., will soon begin the erection of an electric-light plant and waterworks system.

The Southern California Edison Company, Los Angeles, Cal., has taken out a permit to erect a small substation at San Pedro (Los Angeles).

The Home Telephone Company is contemplating the installation of a new plant in Glendora, Cal. (Los Angeles, Cal., company's headquarters).

The city of Spokane, Wash., will establish an auxiliary pumping plant at its Lincoln Heights reservoir. Bids for equipment will soon be asked.

The Anaheim canning factory, Anaheim, Cal., will increase the capacity of its plant. New machinery and mechanical appliances will be installed.

The plant of the Riverside creamery, at Arlington, Cal., was destroyed by fire. Loss, $15,000. The plant will be rebuilt and new machinery installed.

L. P. Larsen, Colville, Wash., has been granted a franchise to install a waterworks system at Metalline Falls, and to operate an electric-lighting system.

Robert E. Goepel, Port Gibson, Miss., is contemplating the erection of a cotton-seed oil mill at El Centro, Cal.; $800,000 will be expended on the plant.

The Tacoma & Roche Harbor Lime Company, Tacoma, Wash., will shortly ask for bids for installing a gas-producer plant on board its boat "Archer."

A heating and ventilating plant will be installed in the new high school at Beaumont, Cal. Thompson & Elder have the general contract for construction.

The Rose City Concrete Block Company, Portland, Ore., is contemplating the moving of its factory to another section of the city. The plant will be enlarged.

The Spokane Falls Gas Light Company, Spokane, Wash., will spend $500,000 on improvements in 1911. A large addition will be built to its power plant.

A. L. Shreve (the Stayton electric-light plant), Stayton, Ore., has purchased a power site on the Santiam river, and will build a power plant in the near future.

The Electro Lighting Company, Indianapolis, Ind., has been incorporated with $100,000 capital to manufacture an electric automobile light. S. C. Renick, president.

John A. Anderson, San Pedro (Los Angeles), Cal., has applied to the city council for a wharf franchise; if granted, he will build a large fish cannery in this district.

Fred H. Dakin, Redding, Cal., is at the head of a company which will build a gas plant in this vicinity to cost over $100,000. The company will manufacture producer gas.

The Eel River & Southern Telephone Company has been incorporated at Eureka, Cal., for $20,000 and will operate in this section. H. D. Smith is at the head of the enterprise.

The Grangeville Electric Light and Power Company, Grangeville, Idaho, is building a hydroelectric plant. Pelton waterwheels will be installed. Other equipment will be required.

The Elma Shoe Manufacturing Company (E. S. Gaultier, Sumas, Wash.) will establish a shoe-manufacturing establishment at Elma, Wash. Shoe-making machinery will be required.

The Wabash Pearl Button Company, Delphi, Ind., has been incorporated to manufacture buttons. Capital, $20,000. Incorporators, Lewis Hall, Alfred H. Brewer, Wm. Donlin.

The Pacific Coast Condensed Milk Company, Seattle, Wash., will build four factories in Illinois, Iowa, and two in Wisconsin. Construction has been commenced on two of these plants.

The Klicklitat Irrigation and Power Company, Prosser, Wash., and outside capital, will expend $6,000,000 for an irrigation system of 300,000 acres in the vicinity of North Yakima, Wash.

The Hamilton Bottle and Glass Company, Arcadia, Ind., has been organized with $70,000 capital to manufacture bottles, jars, etc., by John Holland, Henry O'Meara, E. N. Messick, etc.

The Cascade Light and Power Company, Vancouver, Wash., has been incorporated for $2,000,000 and will build a power plant on the Lewis river. H. W. Arnold is at the head of the enterprise.

The Northwestern Asbestos Company, Denver, Colo., has leased property on Casper mountain, Wyoming, and is building a fiberizing mill. The company contemplates the installation of a tramway.

The Hardegan Axle Company, Indianapolis, Ind., has incorporated for the purpose of manufacturing auto parts and accessories. Capital, $10,000. Incorporators, E. C. Hardegan, C. W. Lauer, H. Wetzel.

W. E. Herris, Santa Barbara, Cal., is at the head of a company which will build a rock-crushing plant at Corona, Cal. The plant will have a capacity of 1500 tons daily. Work on developing the deposits will begin at once.

Power-plant apparatus, a vacuum-cleaning system and refrigerating plant will be installed in the apartment hotel to be erected at Los Angeles, Cal., by the South Main Street Improvement Company (L. J. Christopher and associates). About $250,000 will be expended.

CANADA

Dundas, Ont., will equip a new hydro-electric station.

Moncton, N. B., will spend $250,000 extending its waterworks plant.

Edmunston, N. B., will install a complete new electric-lighting plant.

Montreal will spend $2,000,000 installing a municipal electric-lighting plant.

Port Arthur, Ont., will make extensive improvements to its street-lighting plant.

Simcoe, Ont., will spend $75,000 on installing a modern sewage-disposal plant.

The Canada Rubber Company, of Montreal, is building a new factory to cost $250,000.

The Wayagamite Company will build a 100-ton pulp and paper mill at Three Rivers, Quebec.

The Quebec Railway, Light, Heat and Power Company is building a $200,000 plant at Quebec.

Ottawa will spend $750,000 on drainage and waterworks and much new equipment and supplies will be required.

Messrs. Reed, McRae & McNerny, of North Hatley, Quebec, will build a large sash and door factory at that place.

The Winnipeg Electric Railway Company will build a large new steam turbine power station at a cost of $75,000.

Price Brothers will build a large new pulp and paper mill, at Rivere du Sable, Quebec, and equip a plant to deliver 14,000 horsepower.

The city of Winnipeg is calling for tenders for the equipment for two separate waterworks pumping plants, each with a capacity of one million gallons a day.

Galbraith & Sons, of New Westminster, B. C., are building one of the largest sawmills in the West, on the Lulu island, and will equip it with the most modern machinery.

MEXICO

The Madera Lumber Company, state of Chihuahua, Mexico, is building a new sawmill.

The Santa Rosa Lumber Company, state of Vera Cruz, Mexico, will increase the capacity of its mill.

The Durango & Llano Grande Railroad, Mexico, will build a series of sawmills and erect a tie-treating plant in the state of Durango.

The Mountain Timber Company, state of Durango, Mexico, will build a sawmill of 190,000 feet daily capacity for the manufacture of boxes, doors, etc.; $800,000 will be expended for building and equipment.

MINING

The Santo Domingo mine, Jalisco, Mexico, will build a 100-ton plant.

The Esperanza mine, El Oro, Mexico, will increase the capacity of its mill.

The Belmont mine, Tonopah, Nev., is contemplating the erection of a mill.

The Congreso mine, Chihuahua, Mexico, will install a new pumping plant.

The Mono mine, near Kreka, Cal., will install new machinery at its property.

The Argonaut mine, Plumas county, Cal., will install new hoisting equipment.

The Timmins mine, near Cobalt, Ontaria, Can., will build a large mill in 1911.

The Progreso mine, Chihuahua, Mexico, will install a 50-ton mill and cyanide plant.

The Guadalupe-Parral mines, Parral, Mexico, will install new pumping equipment.

The Tigre mine, Sonora, Mexico, will install new filtering equipment in its mill.

The Cinco Minas mine, Jalisco, Mexico, will install a new plant of 200 tons capacity.

The Defiance mine, Inyo county, Cal., is contemplating the erection of a smelting plant.

The Bear Creek Mining Company, operating in the Cordova district, Alaska, will install a mill.

The Amajac mines, state of Jalisco, Mexico, will increase the capacity of its reduction plant.

The Alaska Gold Dredging Company, Alaska, is contemplating the erection of a new dredge.

The Rice properties, in the vicinity of Cordova, Alaska, will increase the capacity of its stamp mill.

The Consolidated Mining Company, operating at Casados, state of Jalisco, Mexico, will build a 200-ton mill.

The Lucky Strike Mining Company, operating in the Cordova district, Alaska, will erect a new mill in 1911.

The Yuba Consolidated Goldfields Company, operating in Yuba county, Cal., will install a new dredging equipment.

The Mina Mexico mine, in the Sonora district, Mexico, will install a pyritic smelting plant, 100 tons capacity.

The Inde Gold Mining Company, operating the Potrillo mine, Durango, Mexico, will enlarge its reduction plant.

The Pan-American Mining Company, operating in the state of Tepic, Mexico, contemplates the erection of a mill.

Rafael Zepeda, operating in the Guanacevi district, state of Durango, Mexico, will install a mill in this section to cost $300,000.

The Golconda Mining Company has been incorporated at Valdez, Alaska, for $100,000 and will erect a complete plant on Culconda creek.

The Ajax Mining and Exploration Company, operating in the Arivaca district, near Tucson, Ariz., is contemplating the erection of a mill.

The Copper Belt Mining Company has purchased the Michigan mine, near Hartville, Wyoming, and contemplates the erection of a smelter.

The Washington mine, at Cordova, Alaska, will install a stamp mill on its property. Judge Mason, Cincinnati, Ohio, is at the head of this enterprise.

The Brooklyn-Arizona Mining Company, operating the Nellis mines, Yavapai county, Ariz., is planning extensive development work on this property.

The Chefoo mines, in the National district, near Goldfield, Nev., will soon begin extensive development work. G. B. Holleran is the head of this enterprise.

The Calumet & Sonora Mining Company, Cananea, Mexico, is making plans for extensive operations in 1911. An electrostatic plant will be installed.

The Anaconda Company ,operating in the vicinity of Butte, Mont., is installing a new hoisting plant ou its property. The improvements will cost about $400,000.

The Plein Mining and Dredging Company, operating on Otter creek, Alaska, contemplates the building of a new dredge in 1911. Modern machinery will be installed.

The Copper River & Northwestern Railway, Alaska, is contemplating the erection of a smelting plant on Cordova Bay. E. C. Hawkins, chief engineer of the company.

The United States Tungsten Company has filed articles of incorporation at Ely, Nev., for $1,000,000. The company will operate at the tungsten mines, near Osceola, and will soon begin active development.

BUSINESS ITEM

The Triumph Electric Company, of Cincinnati, Ohio, has opened a sales office at 726 Poydras street, New Orleans. A large stock of standard machines will be carried at the New Orleans office for immediate shipment.

TRADE CATALOGS

The Sigourney Tool Company, Hartford, Conn. Pamphlet. Drill presses. Illustrated.

The Walton Company, Hartford, Conn. Catalog. Walton extractor of broken taps. Illustrated, 3½x6 inches.

The Bristol Company, Waterbury, Conn. Bulletin No. 152. Patent steel belt lacing. Illustrated, 12 pages, 8x10½ inches.

Colburn Machine Tool Company, Franklin, Penn. Bulletin No. 44. Colburn floating reamer holder. Illustrated, 6 pages, 6x9 inches.

M. B. Hill Manufacturing Company, Worcester, Mass. Catalog. Machine dogs for the lathe, milling machine and grinder. Illustrated, 3½x6 inches.

Morrow Manufacturing Company, Elmira, N. Y. Catalog. Iron set screws, cap screws, nuts, bolts. Illustrated, 16 pages, 5x7 inches, paper. Folder. Morrow ball-bearing drill chuck. Illustrated.

FORTHCOMING MEETINGS

National Metal Trades Association, annual meeting, April 14, 1911, New York City, Hotel Astor. Robert Wust, commissioner, New England building, Cleveland, Ohio.

American Foundrymen's Association, annual convention, Pittsburg, Penn., May 23 to 26, 1911. Richard Moldenke, secretary, Watchung, N. J.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G.Smith, Columbia, Pa.

B. Jahn, New Britain, Conn., makes dies, tools, specialties and stampings.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Wanted—Contract work or light weight specialties to build. Wm. A. Cather, Pottsville, Penn.

Special machinery designed; drafting, tests, reports. Reliance Eng. Co., 113 Beekman street, New York City.

Have profitable machine shop patent, wish to manufacture. Investors write, W. N. Mesick, 1 Bradford St., Albany, N. Y.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

The Brunswick Refrigerating Co., of New Brunswick, N. J., are prepared to take on one or more manufacturing propositions.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Rivett back geared Precision lathe, 8½-inch, counter-treadle, raising blocks, miller; other attachments; little used. Box 412, AM. MA.

Wanted—To exchange an 8-horsepower Fairbanks-Morse stationary gas engine for a small engine lathe. Hubbard Spring Company, Pontiac, Mich.

Wanted—An article to manufacture suitable for the railway, automobile or hardware trade; must be patented and exclusive. Address Box 356, AMERICAN MACHINIST.

Tools, dies, jigs and light and medium weight machinery designed and built to order; duplicate parts, either machined or die cast. Precision Die Casting Co., Syracuse, N. Y.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Cummings Machine Company, 238 William street, New York. Estimates given on automatic machinery, bone hardening, grinding and jobbing; uptodate plant; highest grade work done with accuracy and despatch. 'Phone 5592 Beekman.

Waned—A builder to manufacture roller and ball bearings in quantity; these bearings are entirely frictionless and require no lubrication of any kind; they have been thoroughly tested on the most trying work; will give five-year contract. Box 414, AM. MA.

The annual meeting of the stockholders of the Hill Publishing Company, for the election of directors for the ensuing year and for the transaction of such other business as may properly come before the meeting, will be held at the offices of the company, in the Hallenbeck Building, 497-505 Pearl St., Borough of Manhattan, New York City, N. Y., on Tuesday, January 31, 1911, at 12 o'clock noon. Dated, New York City, December 9, 1910. Robert McKean, secretary.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

Wanted—First-class toolmaker in Connecticut. Box 389, AMERICAN MACHINIST.

Wanted—First class draftsman, one experienced on jig and fixture work; Connecticut. Box 388, AMERICAN MACHINIST.

Wanted—A designer experienced in the development of ignition apparatus for automobiles, including the design of magnetos, distributors, etc.; a pleasant and profitable position with a growing concern now well established in the trade is open for a first class man. Box 405, AMERICAN MACHINIST.

ILLINOIS

Two good mechanical draftsmen, must be familiar, in a general way, with pumps, shearing machines, tools and engines, $75-$90. Box 401, AMERICAN MACHINIST.

Mechanical engineer wanted; capable of taking general foremanship of machine shop and drawing room, employing about thirty-five machinists; must be good draftsman and designer and capable of developing ideas; give references and salary expected; a permanent position to the right man. Box 391, AM. MA.

Growing Chicago company making small electrical machinery, desires to communicate with man who can take complete charge of manufacturing end; must be a finished mechanic, with practical ideas and executive ability; man who qualifies will be given opportunity to become financially interested; give full particulars, age, salary, experience, etc., in confidence. Box 390, AMER. MACH.

IOWA

Wanted—Draftsman, experienced in designing dies for heavy machine work; prefer one acquainted with hydraulic machinery. Box 357, AMERICAN MACHINIST.

Competent mechanic to take charge of and financial interest in gasolene engine factory and develop with the business; fine opportunity for the right man; give experience. New Hampton Mfg. Co., New Hampton, Iowa.

MASSACHUSETTS

Wanted—An experienced mechanical draftsman, preferably with a technical education, or a number of years' practical shop experience, by a large manufacturing concern in Massachusetts; state age, experience and salary expected by addressing "Chief Draftsman," Box 383, AMERICAN MACHINIST.

Wanted—Foreman for maintenance shop of manufacturing concern; must have general machine shop experience and be familiar with millwright work, installation, care and repair of machine tools, steam, gas, water piping systems, pumps, fans, electric motors, electrical lighting systems; able to handle men; position permanent if service satisfactory; state age, experience and salary desired. Address "Foreman," Box B, Springfield, Mass.

MICHIGAN

Wanted—At Jackson, Mich., draftsman, experienced on axle, transmission and general gear work; state full particulars in first letter. Box 361, AMERICAN MACHINIST.

MINNESOTA

Wanted—Cream separator, bowl balancers; good position; answer immediately. Box 375, AMERICAN MACHINIST.

First class mechanic as foreman of machine department; must have had previous experience in charge; good executive, familiar with modern shop methods and practices and who can secure maximum output from screw machines, automatics and grinders; a strong, sober man required and for the right man we have an unexcelled opportunity. Box 404, AMERICAN MACHINIST.

NEW JERSEY

We want a first class man as a production man; his qualifications must be, first: a thorough knowledge of high speed steels and the results that can be obtained from same; second: must be a thorough all-around mechanic, one who can instruct men and demonstrate to them what can be obtained in the shape of output on any machine tool; must be first class executive and a man who can obtain results without causing friction or trouble; about one hundred and fifty men are employed and the position will be a permanent one with a good salary if the man can make good. Box 384, AMERICAN MACHINIST.

NEW YORK

Grinders Wanted—First class men on Norton crankshaft grinders; also on internal and plain grinders; steady employment for good men. F.I.A.T., Poughkeepsie, N. Y.

Wanted—Experienced draftsman, familiar with rolling mill machinery and furnaces; state past experience and salary wanted. Address Lock Box 202, Massena, N. Y.

Wanted—Mechanical draftsman, who has had experience in designing woodworking machinery; A-1 man required; state age, experience and reference. Box 365, AM. MACH.

Wanted—First class screw machine hands, lathe hands, milling machine hands and draftsmen, experience in automobile work; good wages, steady positions. Apply by letter. Maxwell-Briscoe Motor Co., Employment Bureau, Tarrytown, N. Y.

Machine tool salesman, with mechanical training; such with theoretical and practical knowledge of gear cutting machinery preferred; state salary, experience, former occupation and territory in which best acquainted. Box 386, AMERICAN MACHINIST.

OHIO

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Wanted—A leading draftsman, experienced on hoisting engine work; in reply state age, experience, reference and salary expected; an excellent opportunity for a good man. Box 370, AMERICAN MACHINIST.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

WEST VIRGINIA

Wanted—Experienced die setter to take charge stamping department of can factory; state experience, salary and present employment. Address "Die Setter," AM. MACHINIST.

Wanted—Man with considerable mechanical experience to superintend large plant manufacturing principally tin cans; capable of successfully handling three to four hundred hands; must have experience and executive ability; reference. "Cans," AMER. MACH.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Engineer, draftsman and designer (28), Scotch, 12 years' experience, steam engines and general machinery in shop, office and college, wishes situation in Ontario as assistant engineer or designer; moderate salary with prospects of advancement. Box 413, AM. MA.

CONNECTICUT

Superintendent or works manager with wide experience on tools, dies and general manufacturing; systematic organizer and executive; equal to large proposition; will consider change. Box 408, AMERICAN MACHINIST.

Cost accountant and office manager; eight years' experience; systematic, progressive; can produce results; permanent; at present employed by large manufacturing concern; highest references. Box 395, AMER. MACH.

Automatic screw machine foreman wishes change; sixteen years' experience; systematic and uptodate; familiar with all makes of machines; expert on Brown & Sharpe and National-Acme; good paying position only; location immaterial. Box 394, AMER. MACH.

ILLINOIS

Man with technical education, ten years' experience with a great variety of machinery as designer, estimator, pricer, catalog compiler and department organizer, desires connection as assistant sales manager or similar position with jobbing or manufacturing company. Box 402, AMERICAN MACHINIST.

INDIANA

Wanted—Position as superintendent or foreman by first-class practical man; twenty-five years in the trade, fourteen years as tool room and general shop foreman, three years with present employer; am 39 years old and married; A-1 references. Box 385, AM. MA.

MASSACHUSETTS

Superintendent and factory manager, with experience on metal working machinery and steam engines, aggressive and practical, desires change. Box 397, AMER. MACHINIST.

Machinist, toolmaker and draftsman, wishes position as foreman with reliable parties or company where his efforts would be fully appreciated; A-1 reference. Box 382, AM. MA.

MICHIGAN

Open for engagement April 1; mechanical engineer, experienced in the design and manufacture of steam, power and centrifugal pumps. Box 373, AMERICAN MACHINIST.

NEW JERSEY

Master mechanic, dies, tools, manufacturing; age 36; initiative ability; good executive; references; salary $1800; go anywhere. Box 410, AMERICAN MACHINIST.

Mechanical superintendent for many years and at present well connected; rare practical shop experience; A-1 designer; technical; mechanical engineer. Box 673, Burlington, Vt.

Practical expert tool and die designer is open for position as superintendent or master mechanic; familiar with modern machine tools; 20 years' experience; first class references given and exchanged; interview at any time. Box 393, AMERICAN MACHINIST.

Mechanical engineer, 30, married, specialist in general and special machine tools, college graduate, Berlin, Germany, four years' shop practice, six years designer, estimator and assistant of manager, wishes to make a change; best references; will go anywhere. Box 406, AMERICAN MACHINIST.

NEW YORK

Draftsman, designer, experienced, seeks position. Box 358, AMERICAN MACHINIST.

Technical school graduate wishes permanent position with machinery supply house; moderate salary. Box 403, AMER. MACH.

Uptodate machine shop foreman desires to make a change; 37 years of age, with broad experience on machine tools, jigs, dies and fixtures; references. Box 392, AM. MACH.

Superintendent, master mechanic or chief engineer, practical and technical training, manufacturing, construction, foundry, hydraulic, electric, marine, railroad and stationary engineering, wishes position. Box 409, AMERICAN MACHINIST.

A-1 mechanic, uptodate in modern methods; 22 years' shop experience, 10 years in executive position, wishes position as tool room or general machine shop foreman; good references; location New York, Connecticut or Rhode Island. Box 387, AMER. MACHINIST.

Tool and diemaker with 16 years' experience (six years in own experimental and model shop), wishes position with responsibility or permanent position at experimental and model work; practical designer for novelty work, tools for typewriters, adding machines and vending machines; good reason for changing; A-1 references. Box 407, AMERICAN MACHINIST.

OHIO

Competent designer and draftsman desires change; age 30; shop experience; western States preferred. Box 379, AMER. MACHINIST.

Man, with 20 years' experience in brass shop, 15 years as foreman of tool room, wishes to make a change; West preferred; age 38. Box 369, AMERICAN MACHINIST.

Works superintendent; expert on methods and small tool design, machine tools or any interchangeable product; have shown 60 per cent. increase in production from 166 machine tools in six months; American; age 42; West of Pittsburg preferred. Box 399, AM. M.

Position as works manager or superintendent; 14 years' experience in executive positions; a hustler having made good handling 2000 employees; ten years with present company; good reasons for changing; can earn $6000 year; age 35 years. Box 396, AM. MA.

PENNSYLVANIA

Tool designer and foreman wishes change; sober, steady, practical mechanic; 18 years' experience; A-1 references; go anywhere. Box 398, AMERICAN MACHINIST.

Foreman desires position; age 34; wide practical experience in assembling and turning departments; also small machinery requiring accurate interchangeable parts. Box 400, AMERICAN MACHINIST.

Foreman metal patternmaker, 10 years foreman and uptodate in all kinds of pattern work and molding machines, also model and experimental work, mechanical draftsman with inventive ability, wish to take charge. Box 411, AMERICAN MACHINIST.

FOR SALE

An opportunity to start a machine shop; we offer one of our departments for sale, the one used to establish our business; it is small and profitable work, but as we are devoting ourselves to heavier work, we offer to sell for $2000, all the drawings, patterns, and stock of finished and partly finished parts and rough material (inventories over $3000), circulars, electrotypes, special machinery and fixtures, and an established trade. Address Sipp Machine Company, Paterson, N. J.

Talks With Our Readers

By The Sales Manager

All is not grist that comes to the AMERICAN MACHINIST mill—in advertising any more than in the editorial contributions.

We are just as careful to exclude all products foreign to the machine-making field from our advertising columns as we are descriptions of them from our editorial columns.

* * *

A case in point.

Some time ago the advertising representative of the Howard Watch Company wanted to spend about a thousand dollars in the advertising columns of the AMERICAN MACHINIST.

You know how good a Howard watch is.

How it is one of the standard watches of America, and how well and truthfully it is advertised.

How it meets all of the requirements of an advertisement to go in our columns except one, and that is:

It isn't directly in our line.

The representative of the Howard Watch Company was surprised when we returned the order.

He asked if their money wasn't good enough for us.

We replied that it wasn't a question of money at all—it was a *principle* with us.

We could double our advertising revenue for a while if we took advertising of watches, shoes, clothes, soaps, safety razors, etc.

But then you would not value the AMERICAN MACHINIST so highly.

* * *

We do not want any advertising in the AMERICAN MACHINIST that does not relate directly to the machine making industry.

Each advertisement in the AMERICAN MACHINIST is of some product that can be used in a machine shop.

Without exception, we might say used to advantage in the making of machinery of some kind.

There's nothing foreign to distract your attention—nothing but news and information about your work.

Each advertisement carries a direct message to the man responsible for results in machine-making plants—

To you.

* * *

Only reliable products can be continuously advertised.